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Engines and Boilers for the Wrecking Boat "Right Arm."

The accompanying illustrations are of a compound engine and boiler for the wrecking boat named "Right Arm," recently completed by Messrs. Brown & Miller, Vulcan Iron Works, Jersey City, N. J.

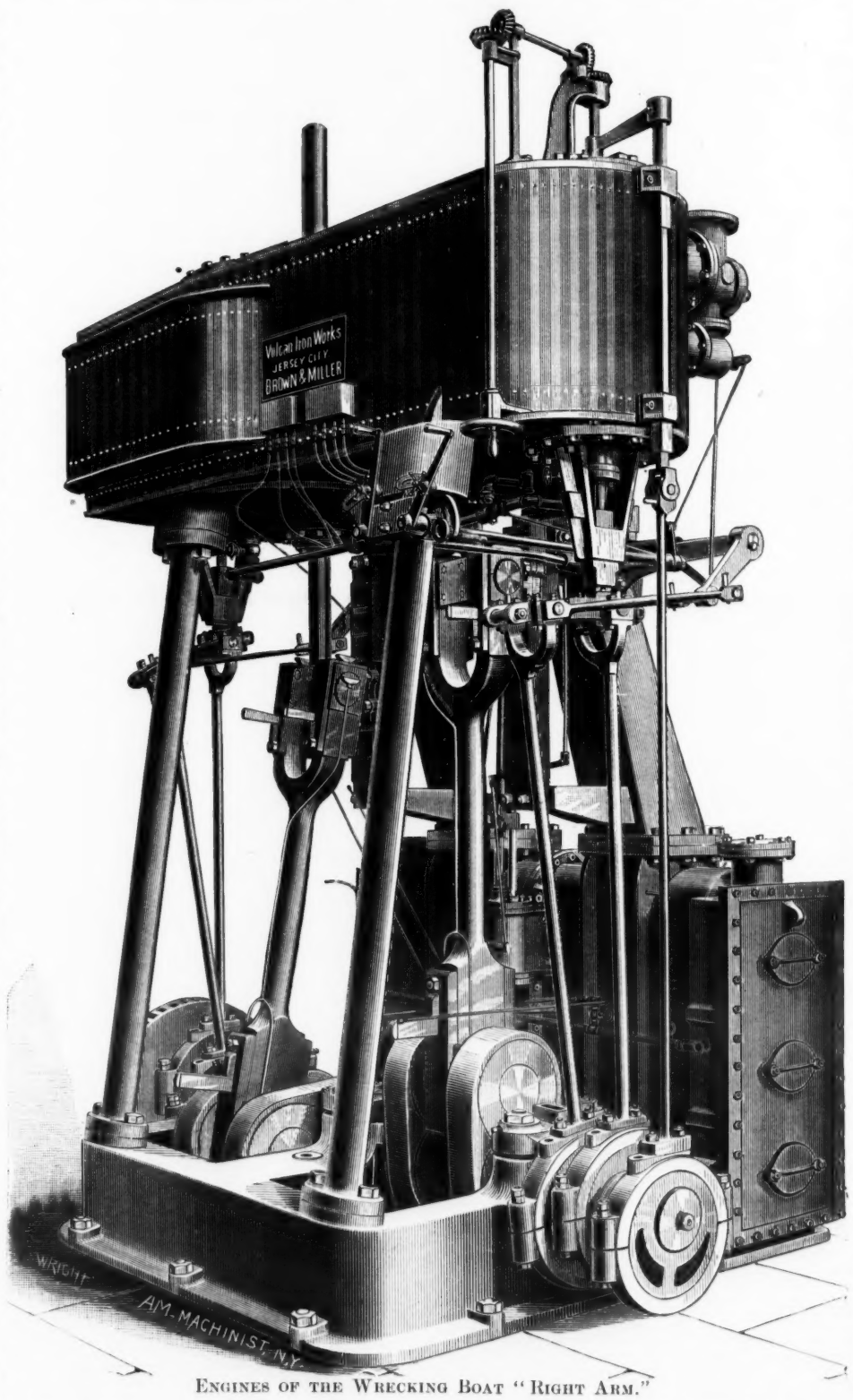
The boat was built for the Davis Coast Wrecking Corporation, of New Bedford, Mass. Judging from the short time she has been in service, she will undoubtedly give a good account of herself. The boat left Jersey City for New Bedford on the 11th inst., and although she had no preliminary trial trip, her speed averaged about 12½ miles per hour, with a steam pressure of about 95 pounds. Before her destination was reached she was called upon to tow a large vessel drawing 20 feet of water into port, which was successfully done; and since that time has been at work on three wrecks.

The hull is built of wood; length, 133 feet; beam molded, 26 feet; depth of hold, 10½ feet. The high-pressure cylinder is 20 inches diameter; low-pressure cylinder, 40 inches diameter; stroke of pistons, 26 inches; these cylinders are shown separately in Figs. 1 and 2. The high-pressure cylinder is fitted with a piston valve, having a cut-off valve inside. This design is patented by Messrs. Brown & Miller. The low-pressure cylinder is fitted with a double-ported slide valve. The piston packing consists of narrow cast-iron rings, fitted between the follower and piston with light springs behind them. The crossheads are made of wrought-iron, finished all over and provided with brass gibs. Piston rods are made of steel, $3\frac{7}{16}$ inch diameter, and the connecting rods are made of wrought-iron. The links are made of steel of the bar type, with cast-steel link blocks and brass gibs. Crankshaft is made of steel, 9 inches diameter; and the steel crank-pin is 9 inches diameter and 9 inches long. The crank slabs are made of wrought-iron, 6½ inches thick. The condenser forms part of the framing, and contains 800 square feet of cooling surface. The engine is provided with an independent Blake air-pump; steam cylinder, 8 inches diameter; air cylinder, 12 inches diameter; both 12 inches stroke. There is also an independent Blake duplex marine feed-pump, and an independent circulating pump.

The engine is also fitted with what has proved a very efficient steam reverse gear of Brown & Miller's design, and which they have patented. It gives the engineer perfect control of the engine and entirely prevents the "slamming" of the link when reversing.

The propeller is 9 feet diameter and 12½ feet pitch; sectional type. The boiler is shown in Fig. 3. It is of the return tubular type and contains 56 square feet of grate surface. The steam drum is built separate from the boiler, and is supported by wrought-iron beams and held in position by braces whose center lines are indicated by the dotted lines *A* and *B*. An 8 inch copper pipe forms a connection between the drum and boiler.

We are informed that the boat and the working of the machinery have proved to be very satisfactory to the designers and builders.



ENGINES OF THE WRECKING BOAT "RIGHT ARM."

The Value of a Water-power.

One of the most valuable and interesting papers recently presented before the American Society of Mechanical Engineers is that by Mr. Chas. T. Main, on "The Value of a Water-power." In this paper Mr. Main makes a study of what should be taken into consideration in estimating the value of a water-power, especially where a part or all of the power is taken or encroached upon by others, or where it is appropriated for some public use by condemnation, and the proper compensation is to be determined. In such cases, engineers are usually called upon as experts by one side or the other, and consequently a systematic and intelligent study of the question, such as Mr. Main presents, has, we think, great value. It is too often assumed that the value of a water-power "is represented by a sum of money which, when put at interest, would maintain a steam plant of the same power in the same place." But Mr. Main shows that the problem of fixing a value is nearly always a much more complicated one than this. The paper is too long for reprinting in our columns, but we give some extracts from it as follows:

. . . . . "The essential points which must be considered, as to whether an undeveloped power can be developed and used to a greater profit than any particular business or the general run of business could be conducted elsewhere with a different source of power, are as follows:

a. Quantity of water during a dry year.

b. Uniformity of flow during the year, considering the storage capacity, natural and artificial.

c. Head of fall.

d. Conditions which fix the expense of building dam and canal, and flowage of land.

e. Conditions which affect the cost of foundations for buildings.

f. Geological conditions which determine the permanency of the falls.

g. Freight charges for fuel, supplies, raw materials and finished product.

h. How much low-pressure steam can be used for heating purposes, and whether exhaust steam can be used for those purposes.

i. Is water needed for other purposes than power, and in what quantities?

j. The social and sanitary conditions which make it possible to procure and keep good help.

k. The greater uniformity of speed with steam than with water-power.

All the above items except the last two can be estimated approximately in money value.

The power which has the most value is one which has a flow during a dry year which is nearly constant, or which can be made so by storage basins, and which requires no augmentation from other sources. It seems to me to be fair, in determining the value of such a power, to say that if the business which can be conducted there can be conducted elsewhere, where fuel is cheaper, the cost of that water-power can be compared with the cost of steam-power at such places which are suitable for the transaction of such business."

In the case of a developed power, the summing up is as follows:

"*If the power can be run cheaper than steam, the value is that of the power, plus the cost of plant, less depreciation. If it cannot be run as cheaply as steam, considering its cost, etc., the value of the power itself is nothing, but the value of the plant is such a sum as could be paid for it new, which would bring the total cost of running down to the cost of steam-power, less depreciation. That is, it is worth just what can be gotten out of the plant, and no more.*"

"If a portion or all of an undeveloped power is taken away from the owner, a fair compensation for the same would be its market value. But it might and probably would happen with a developed power, if a manufacturing plant had been established there and business carried on, that the damage would be more than the market value of the power or a portion thereof, because of its effect upon the value of the entire manufacturing plant, and the necessity of providing a power for that which has been taken away.

Is the damage in such a case equal to a sum of money which, when put at interest, would furnish a substitute power?

The nearest approach to a case in which the damage would be such an amount is

when a portion of the permanent and developed power is taken away, leaving a portion to the owner.

If so small a portion is taken that no part of the water plant can be dispensed with, then the fixed and running expense of such plant continue. In nearly every case, when a portion is taken, there will be a boiler plant perhaps large enough to produce the amount of power which it becomes necessary to replace. The fixed expense of such plant has to be borne, whether steam or water-power is used. Any portion of a steam plant which it is necessary to maintain and run when water-power is used, can be fairly made to offset a portion of the fixed expense in the cost of steam-power, if such plant can be made a part of the substitute plant.

If low-pressure steam is required for heating purposes and exhaust steam can be used, the heat thus saved should be credited to the cost of coal for running the substitute plant, and the cost of attendance should be proportioned between cost of power and cost of heating.

In figuring the cost of such a replacement of power, any recognized improved methods should be figured on, even if such methods are not in use at the particular place under consideration.

In almost every power which we have considered as constant, there are fluctuations, and the taking of a portion of the water, when there is so much water as to cause back water, would be a benefit rather than a detriment.

If all of the water is taken away then cease the repairs, depreciation, taxes and insurance, and running expense, and such fixed and running expenses will properly go towards maintaining a steam plant.

If a portion of a variable power, which is already supplemented by steam, is taken away, then a portion of the steam plant can be made a part of the substitute plant, and if the steam plant is of necessity of sufficient size to drive the work, then all of the fixed expense, and a portion of the running expense, should go to diminish the cost of replacing the water power.

In case all of the water power were taken away, the fixed and running expenses cease, and, as before, can be applied to diminish the cost of steam-power.

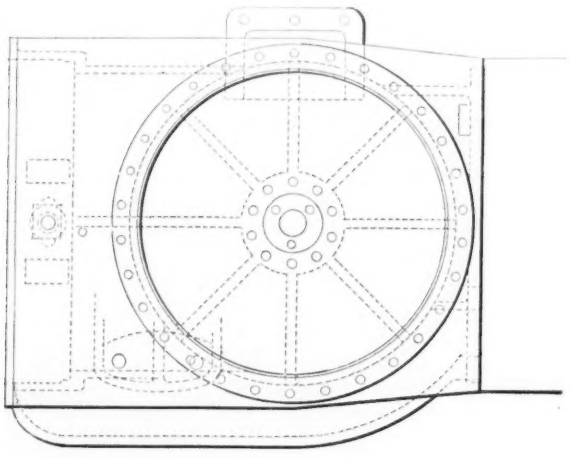
From what has been said I think it has been shown that it would be difficult to find a case in which such a broad statement of the value of a water-power as has been made at the outset would hold good."

Mr. Charles E. Emery, in discussing the paper, said in part: There is one case in regard to compensation for water-power that is not mentioned—a prominent suit in Massachusetts. It was one of the Fall River cases, which has become classical in this sort of work. The first condemnation for the use of the city was about five per cent. of the whole. As they already had to have engines, we, on the side of the city, urged that we were part owners of the engines and ran them a very little harder for a few days in the year, and for that purpose we should reimburse the owners for the costs of their steam plant—for that proportion of the steam plant—and should pay that portion of the expense. The commission was a remarkable one. The county judge was, in the first place, chairman, and James B. Francis and Mr. Leavitt were the other members of the commission, and they adopted that ruling which very much reduced the ruling that was claimed by the property holders, that small engines and small boilers should be put up, and they should be paid on that basis. But the other case was a different one. There was a certain quantity of water used in the print works there, and they urged that the only recompense for water that could be made them was water; that they must have it, that it could not be taken away, and they must have water, and this is a question of condemnation—of taking it all—and it claimed the only damage was the rate which they would be required to pay the city for water by the meter, and they urged it very strongly, and insisted, "We must have the water, and that it is the only place we can get it; that is the measure of damages—no ruling about steam engines would apply to it." The commission limited their ruling in regard to power—of those who use it for power—and the amount of damages was only $18,000 to the whole of them; but there was $10,000 given to this mill; and they said afterwards, "We don't know why we gave them $10,000, but we had to make some concessions in that case"; and it shows the difficulty of handling such matters under all the conditions that arise.

Mr. Robert Cartwright said: I agree with Mr. Emery in regard to that thing, that no rule would apply for the cost of a water-power. I have just put in a register—a 1,200 horse hydraulic plant for the Genesee River; and I tell you the honest truth when I tell you parties are selling their water rights and running their works with steam-power, and saving money by selling their water rights for more than it costs them to run by steam; so the rule don't apply always; every case has to have its own individual figuring. Now, they have got no water at all.

The United States Express Company has discharged a number of its employes for daring to belong to an organization not approved by the company.

A Fitchburg (Mass.) paper, *The Daily Sentinel*, contains an account of the new shops of the Grant Machine Tool Works, of which our correspondent, Mr. John J. Grant, is the central moving spirit. The shop is in operation, and at present is engaged mainly in the making of hardened steel balls for use in ball bearings, these being made by a new process, which is an adaptation of the automatic screw machine principle, the balls being formed on a rod by tools which are manipulated automatically, the same as in a screw machine, the balls being formed without heating. Ten of these machines are at work, and preparations are being made for building twenty more of them as soon as possible. Four grinding machines are used in finishing, and it is designed to have a capacity for turning out 400,000 bicycle balls per week. There seems to be an increasing demand for these balls, and it is stated that the new company has received proposals from England for furnishing about ten millions of them. It is expected that they will take up the manufacture of Governor Howard's multiple ball bearing, which we illustrated in our columns some time ago, and a set of these bearings are soon to be made and tested in street railway service. There is some prospect, also, of the new concern contracting to build a plant for the manufacture of balls to go to England.



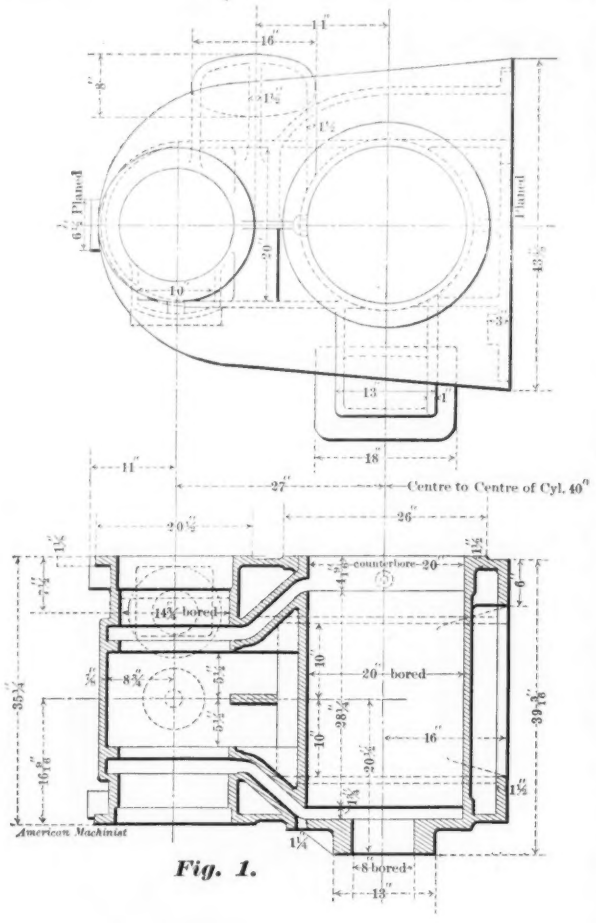


Fig. 1.

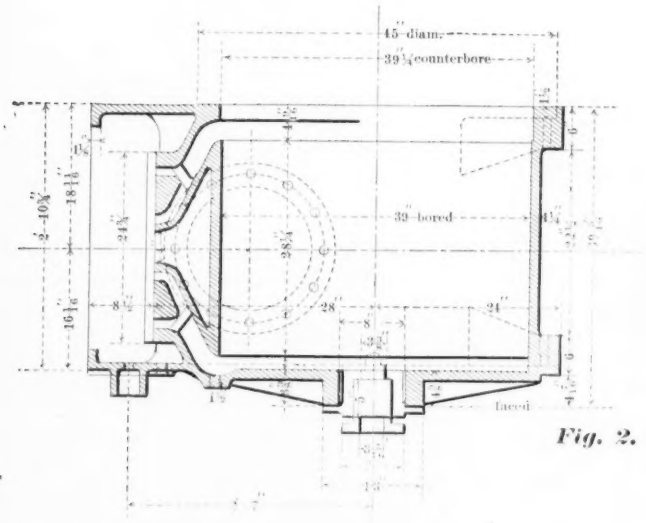
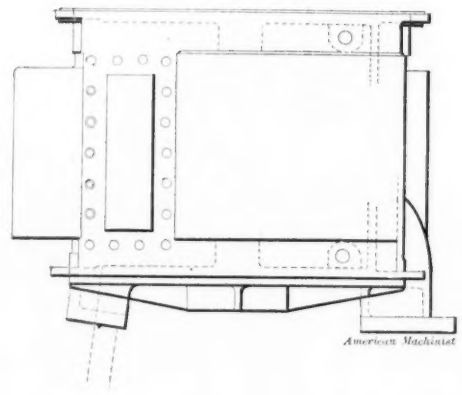


Fig. 2.



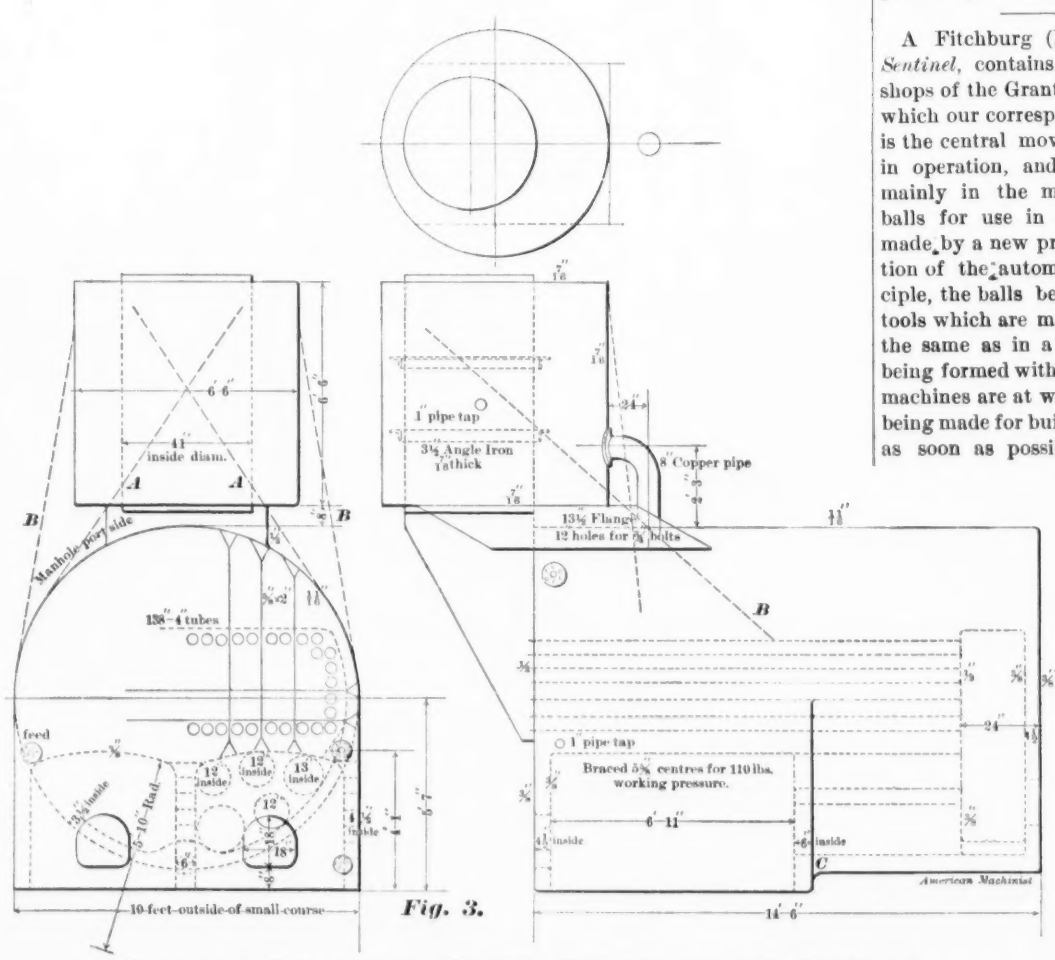


Fig. 3.

ENGINES AND BOILERS OF THE WRECKING BOAT "RIGHT ARM."—SEE PAGE 1.

A New Universal Milling Machine.

It has been known for some time among those who keep track of shop matters, that the Putnam Machine Company, of Fitchburg, Mass., were getting ready to bring out a universal milling machine in which the intention was to adhere closely to the general features of what has now become the recognized standard form of such machines, while at the same time some new features were to be introduced.

We present herewith two perspective and some detail views of this machine, by which it will be seen that the most striking new feature is that of counterbalancing the knee. The method of doing this will be clearly perceived by an inspection of Fig. 2 (page 4). Two sheaves are placed as high as possible in the frame, over which a chain or steel cable passes to a weight at the back of the machine. This weight is sufficient to balance the knee within a small fraction of its weight, and its effect is to lessen the labor of moving the knee, and to reduce the wear upon the mechanism by which this is accomplished. It also makes the handling of the machine more "sensitive" than it otherwise would be, *i. e.*, since the knee requires much less force to raise it to a cut, the cut is much more readily felt, and the action and condition of the cutter with respect to its truth and sharpness more readily perceived.

Fig. 3 is a section of the head showing the arrangement of the spindle and bearings. It will be noticed that the bearings are entirely plain, that the thrust is taken on the rear one, allowing for expansion through the main bearing, the boxes being plain cones outside, which are fitted to conical seats in

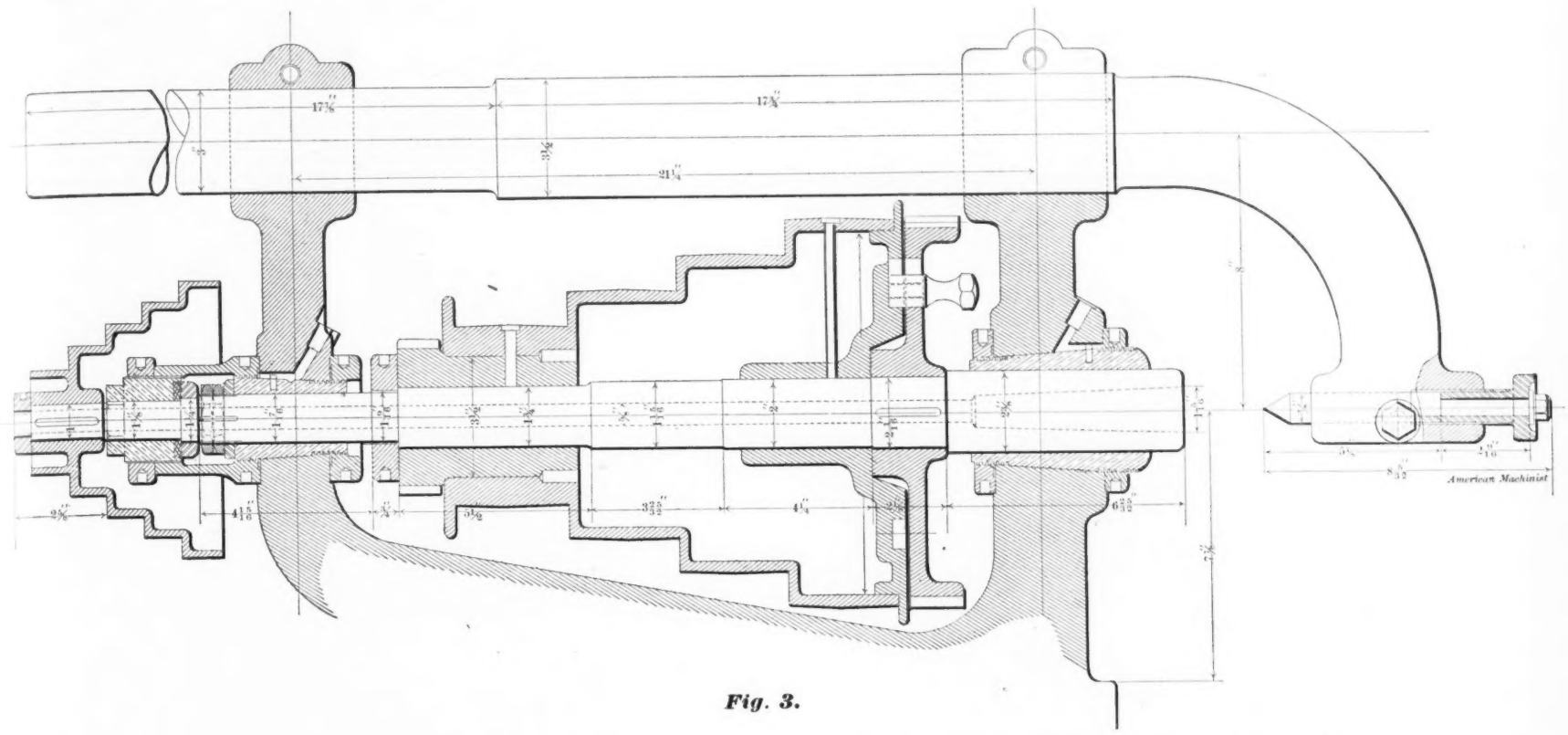


Fig. 3.

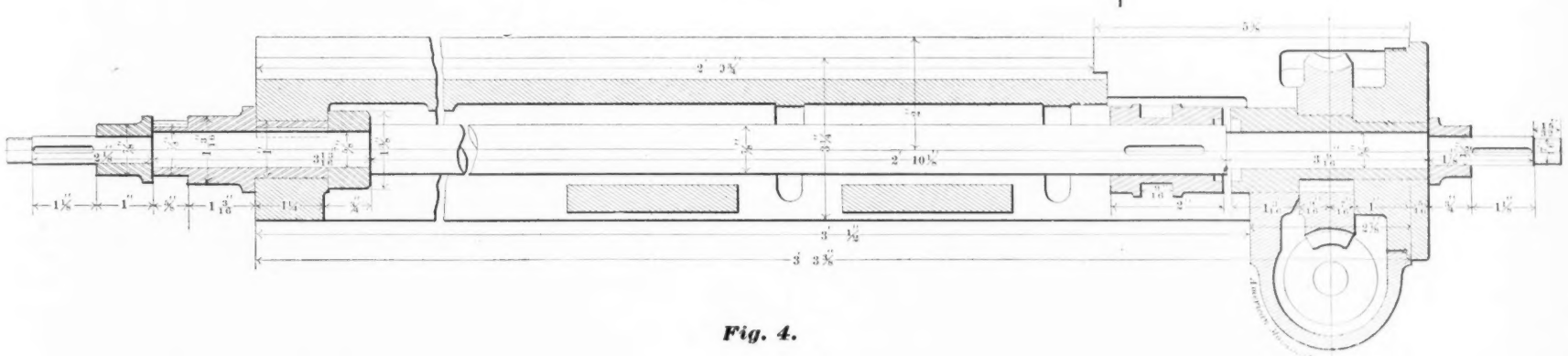
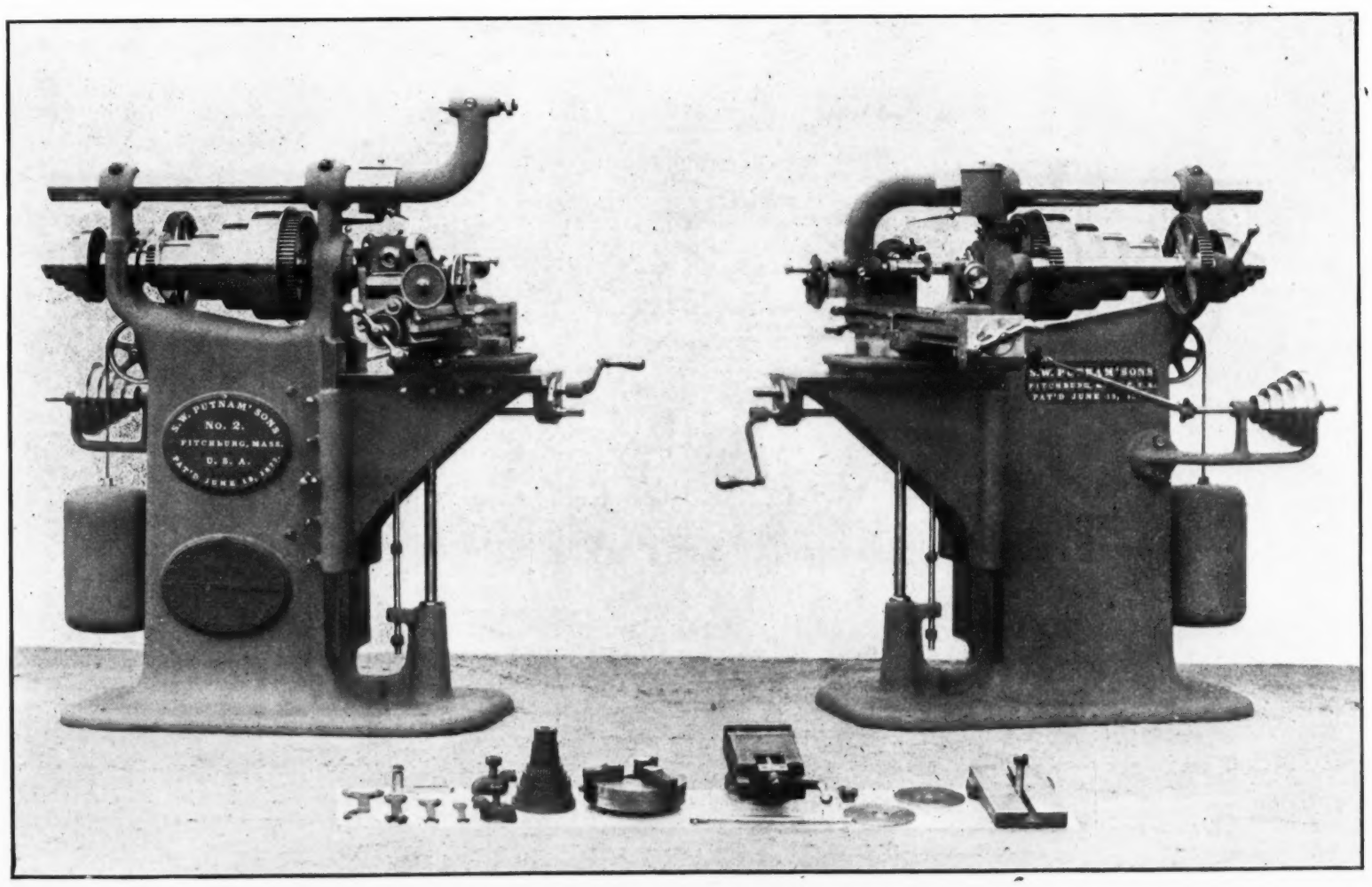


Fig. 4.



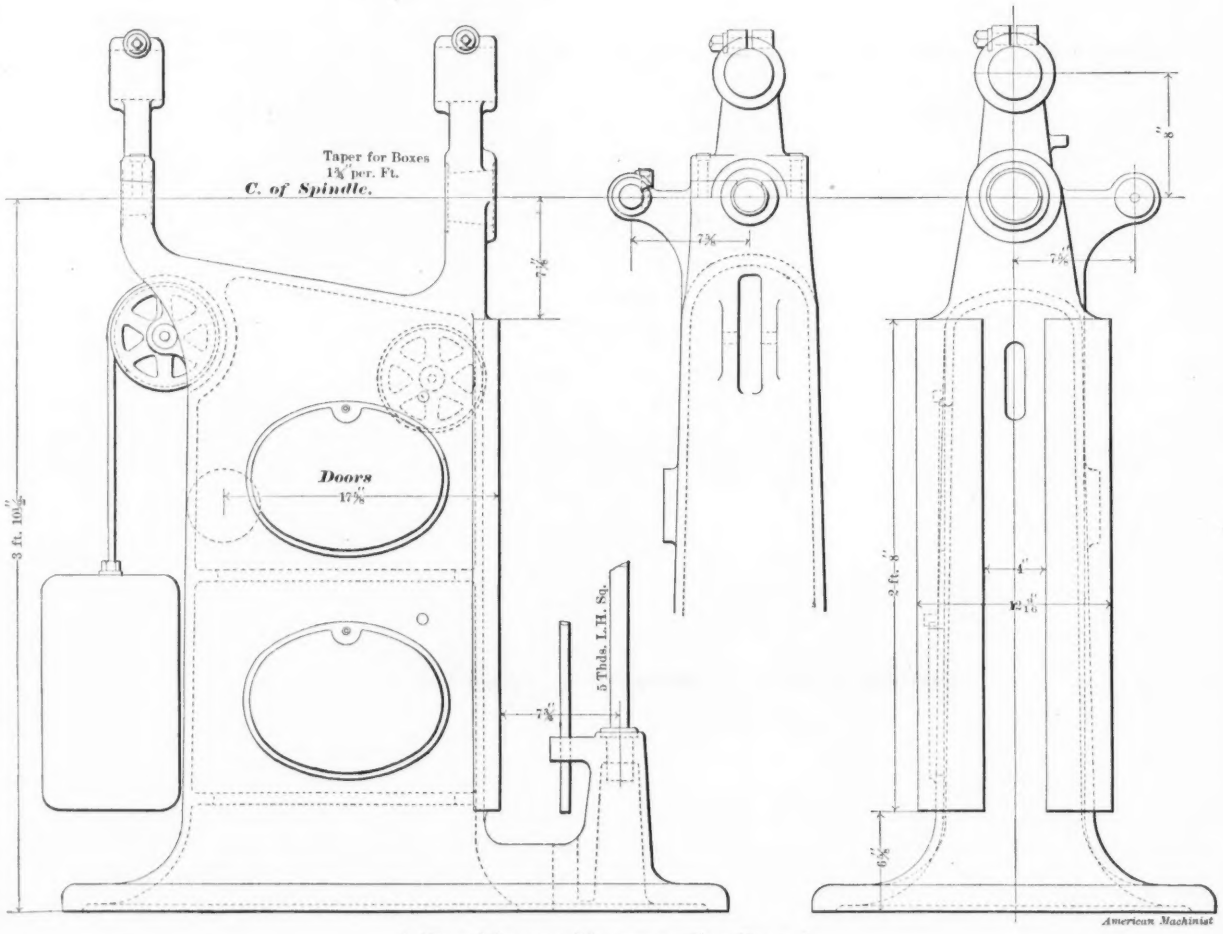
A NEW UNIVERSAL MILLING MACHINE.

the frame and adjusted by threaded rings. They are of composition and are easily renewable. The spindle is hollow throughout, and has the same taper as the Brown & Sharpe machine, the taper in the index spindle being similar, so that the arbors may be used in either.

The machine is back-geared to secure a great range of speeds, the proportions being such that regular gradations are obtained from the fastest to the slowest, and any cutter likely to be used in the machine can be driven at its proper speed.

There are five changes of feed, and the feed screw is driven by worm gearing, so arranged as to leave the top of the platen clear, so that work may extend out over it as far as may be desired without blocking. Balanced handles are fitted to each end of the feed screw, so that it can be handled from either end, as most convenient. Fig. 4 is a section of platen showing the arrangement. Fig. 5 shows the arrangement of the indexing worm-wheel, which is made in two parts, one of which can be turned upon the other by the taper screws shown, so as to take up all lost revolution, after which it can be clamped by the other screws. The base upon which the platen rests is circular and graduated upon the outer face.

The knee has a vertical movement of 17″ upon the column, and the saddle moves 9½″ upon the knee parallel to the spindle. Work 10″ diameter and 20″ long can be swung upon the centers and all the usual operations performed upon it, there being three index plates and gears for obtaining any desired spiral, either right or left hand. The index head can be set at any angle from 5° below the horizontal to the vertical. The machine is provided with all needed conveniences — 6″ universal chuck, vise with jaws 5″ wide, 1″ deep and opening 2⅜″, wrenches, hand wheels, etc. The countershaft has two friction pulleys for 4½″ belt, and should make 100 revolutions per minute. The floor space required is 55″x55″, and the weight 2,850 pounds.



A NEW MILLING MACHINE.—SEE PAGE 3.

Size and Strength of the Gulf Stream.

Even those who navigate its waters do not fully realize the strength of its current. Two or three years ago a government vessel was anchored in the stream, observing the current. The wind was very light, when a sailing vessel was sighted ahead, drifting to the northward. As she came nearer and nearer it became evident that there would be a collision unless steps were taken to prevent it. The crew of the sailing vessel trimmed their sails to the gentle air; but it was useless, for onward she went, carried by the irresistible force of the current directly toward the bow of the steamer. As the vessels approached each other, by a skillful use of the rudder on board the steamer she was moved to one side, and the sailing vessel drifted past a few feet distant. The captain of the latter was as astonished as he was thankful that his vessel was not lost. All that he could cry out in broken English as he flashed by was, "I could not help it; the water bring me here."—*The Century.*

Here is a rather interesting dispatch from London: "Mr. Single, a boot and shoe manufacturer of Leeds, testified that the art of boot and shoe making in America is fifty years ahead of that in England, owing to the use of improved machinery."

Combination Slide Rest and Grinding Fixture.

We present herewith two illustrations of a tool, the value of which will be readily recognized by most machinists, since it is possible by its use to turn, bore or grind work in the lathe at any desired angle, without either a taper attachment or a compound rest.

The tool has a shank which goes into the tool-post in the ordinary manner, the same as a turning tool, and inside the barrel there is a cylindrical slide which carries either the tool or the grinding spindle, as shown.

The tool is especially adapted for turning lathe centers, collets and bevel gears; also for grinding similar work. It will operate upon large and small diameters equally well, the dimensions being limited only by the swing of the lathe. Feeding is done by means of a screw and hand wheel. The tool has a traverse movement of 3½″. To use it for grinding, the slide bar carrying the tool is removed and is replaced by the grinding attachment. The spindle is of tool steel, hardened and ground. Suitable means are provided for taking up all wear in the bearings. It is driven by a round belt from an overhead countershaft. The change from the condition for turning or boring to that for grinding can be made without removing the holder from the tool-post, thus effecting a saving in time and preserving the correct angle. The makers are the Pratt & Whitney Company, Hartford, Conn.

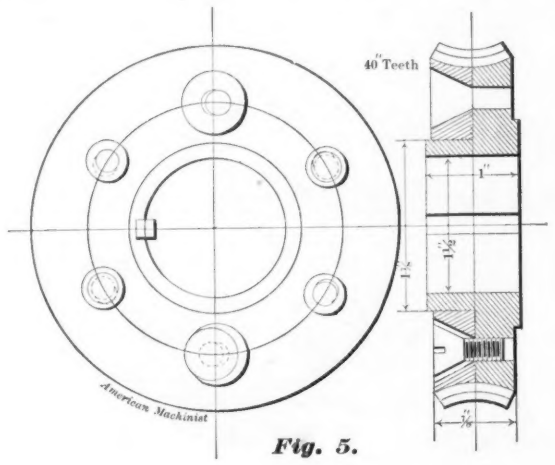
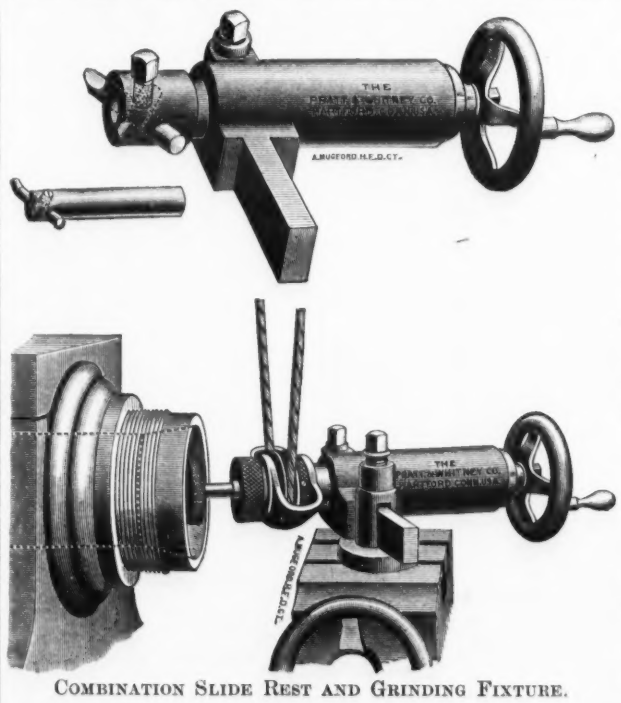


Fig. 5.



COMBINATION SLIDE REST AND GRINDING FIXTURE.

A well-known engineer writes us a letter in which he refers to our comments on the expense account of the U. S. Senate while attending funerals of deceased members, and he says, "This amount [$20,000] certainly is a high price for just one funeral, but I would like to ask if you do not think it would be a cheap and good thing to appropriate, say $20,000 per member of the U. S. Senate and bury the whole lot."

This plan might work very well, but it is to be remembered that before you can have a funeral you must first secure the corpse, and in this case there might be some legal and other difficulties in the way of doing that. Besides, we think there are some members of the U. S. Senate who are disposed to and are capable of accomplishing some good if they are only given a fair chance to do it; but it certainly is true that there are a great many evils connected with that body which should be remedied. Among them, this habit which they have acquired of so recklessly spending the money of the people, in ways which it seems to the ordinary mind they have no possible right to spend it.

The Eye-pointed Needle.

It is a tireless task, cracking the old chestnut that Howe invented the eye-pointed needle. But when so good an authority as *The Hosiery and Knit-Goods Journal* permits it to appear in its columns under a pretentious heading that implies general and expert knowledge of sewing machines, we must hit it a crack. Our contemporary says:

"The needle for a lock-stitch machine, or, in fact, in any sewing machine proper, was patented by Elias Howe, and he had the broad claim of the eye in the point, and thus secured the monopoly."

Now the fact, which has been printed many times, is: Howe did not patent any needle, and nobody ever patented the eye-pointed needle, which had been used in sewing machines long before Howe's time.

One of the claims of Howe's patent was for a *combination* of several parts—all previously used in sewing machines, though that fact was unknown to him — one of which was the eye-pointed needle. The grouping of the needle with the other parts was the gist of his invention. — *Sewing Machine Times.*

At the January meeting of the Engineering Association of the South, held at Nashville, Mr. Olin H. Landreth read a paper on "The Calorific Power of Southern Coals." One of the results presented was that a series of coal tests, covering a large number of southern coals, had developed the fact that there were at least three southern coals which were superior in calorific power to the standard second pool Pittsburgh coal, and but slightly below Cumberland, semi-bituminous coal. It is proposed to have a test or trial of highway machinery, conducted under the auspices of the association, and a committee has been appointed to take charge of the matter and make arrangements for it.

Double-cone Compression Coupling.

The accompanying engravings show the construction of an improved compression coupling for shafting. The coupling is composed of two split shells which are placed on the shaft and are tapered outside to fit two taper sleeves which fit over them, and by engagement with the central ring or collar are drawn together. The cones being entirely separate from each other makes it practicable to properly couple two lengths of shafting which differ from each other in diameter, and as the cones are drawn up by a ring which passes entirely around the coupling, and draws the cones up evenly, there can be no cramping nor unequal drawing up, resulting in running out of true. The two split cones are formed as clutches, and thus do the driving, relieving all other parts of the coupling of the torsional stress. On the larger sizes the cones are keyed by loose keys or pinned to the

shaft, but for the smaller sizes no fastening is required for this, as they are found to drive with nothing more than the friction of the cones upon the shaft.

It will be perceived, of course, that this coupling is an easy one to put on and remove from the shaft—that it is small and neat in appearance and not liable to catch the clothing or a belt. It is made by H. S. Hires & Co., 706 East Fayette street, Baltimore, Md.

DOUBLE-CONE COMPRESSION COUPLING.—SEE PAGE 4.

The Rivett Friction Clutch.

The accompanying engravings show two forms of a new friction clutch which has been devised by Mr. E. Rivett, Brighton District, Boston, Mass.

As will be seen, the clutch is of the expanding ring type, Fig. 1 showing it as applied to a pulley, and Fig. 2 to the feed of a lathe or other machine tool. By reference to the latter engraving the arrangement of the parts will readily be seen. The ring is keyed to a flange which in turn is keyed to the shaft, the key in the ring being diametrically opposite an opening into which is fitted the end of a lever which is of such form that, when this lever is moved, the ring is forced open and engages with the revolving worm. The lever is moved by the pin seen under it, and this pin is moved by the wedge which is seen detached, and which passes through the center of the shaft. It will be noticed that in this form all the mechanism can be kept within the width of the wheel, and that it can be completely covered up, if desired, by a plate attached either to the shaft or to the wheel.

In Fig. 1 the same mechanism is used, except that, instead of the pin being worked by a wedge introduced through the center of the shaft, it is worked by the lever and sliding collar shown. Mr. Rivett, who is manager of the Faneuil Watch Tool Company, writes us that he has tried the clutch in various places, including 16″ and 30″ lathes, and also on a special milling machine, and that it seems to be all that can be desired in the way of a clutch for such purposes. It has also been tested at the works of the Brown & Sharpe Mfg. Co., with, we understand, good results.

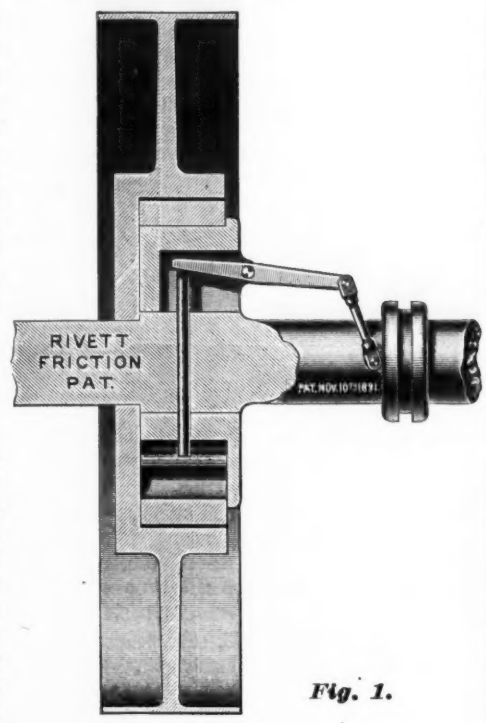


Fig. 1.

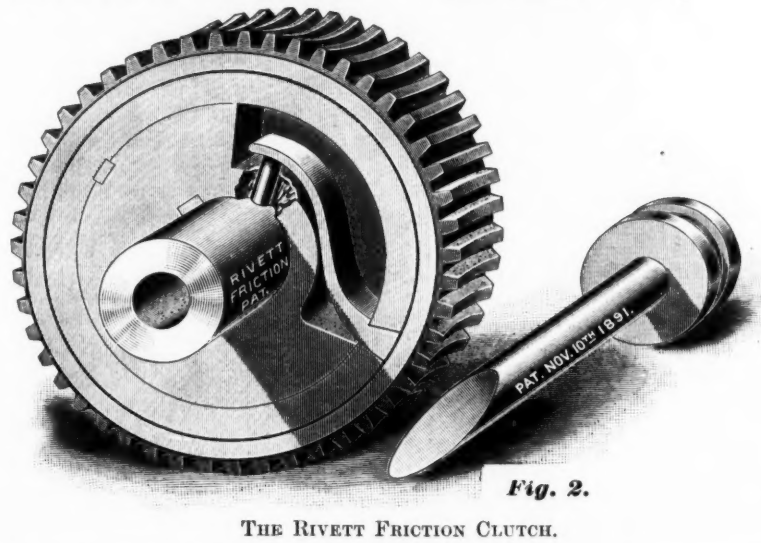


Fig. 2.

THE RIVETT FRICTION CLUTCH.

The Universal Swing Frame Grinding Machine.

The accompanying illustration is of a universal swing frame grinding machine, which is adapted for all that class of grinding in which the utmost freedom of movement of the wheel is necessary, and which usually cannot be done by the ordinary grinding machines.

As is well known, it frequently happens that dies for drop-forging or stamping hollow ware are badly sprung in hardening, and it is sometimes necessary to either grind them to shape by hand, or, where badly sprung, to anneal them. The machine herewith illustrated is intended to enable such dies to be ground to shape rapidly and expeditiously wherever such a method is possible, and to this end the wheel is mounted at the end of a spindle in such a way that it can be applied to the die in any possible shape while rapidly revolving, the die remaining stationary upon the bench.

The machine consists essentially of a countershaft from which a belt runs to a suspended pulley, which is hung in a frame and counterbalanced in such a way that it can be moved in an arc of a circle, the center of which coincides with that of the countershaft.

This admits of any desired vertical movement, while at the same time the spindle is so connected to the frame above as to be at a constant distance from it, and the tension of the round belt which runs from the suspended wheel to the spindle pulley is maintained constant, being adjusted by the sliding joint seen in the vertical rod. The arrangement of the grinding spindle pulley and idler pulleys is such that the belt runs freely and without cramping in any desired position. The bearings for the spindle constitute the handles by which it is guided and applied to the work. The end of the spindle is provided with a taper hole into which arbors can be fitted in the ordinary way, so that holes of any desired form may be used; or, where it is desirable, small milling cutters or burrs can be substituted. The machine is manufactured by Albert L. Colburn, 4 Wall street, New Haven, Conn.

UNIVERSAL SWING FRAME GRINDING MACHINE.

The shops of John W. Sullivan, 384 and 385 South street, New York, present quite a busy appearance. A triple-expansion engine, built for the Bridgeport Steamboat Company, is nearly completed. The high-pressure cylinder is 18; intermediate, 27, and low-pressure cylinder, 42 inches diamter; stroke, 28 inches. This engine will be placed in the passenger steamer "Park City," the hull of which is about ready to be launched. Among other work under way, we noticed a compound engine to be placed in a yacht; cylinders 9½ and 19 inches diameter by 12 inches stroke; also another triple-expansion yacht engine with cylinders 8, 12 and 19 inches diameter and 12 inches stroke. A simple tugboat engine is to be commenced, with a cylinder 15 inches diameter and 18 inches stroke. Besides these there are several smaller marine engines in the shop for repairs.

The *Northern Budget* says: "Yesterday an order was received at the gun factory at the Watervliet Arsenal for twelve more 8-inch guns, and also for twenty-five 3.2 field pieces, which must be turned out as speedily as possible. Work has been commenced on the fifteen 3.6 motors. All the machinery has arrived for the new 185-ton electric crane which is to be used in manufacturing the 12 and 16 inch guns. The new shrinkage pit started in the gun plant was operated for the first time yesterday. For the test, three 12-inch jackets were shrunk with excellent success. Some of the forgings for the 8-inch guns, the new order, have already arrived."

LETTERS FROM PRACTICAL MEN.

How Did It Get Out and Where Did It Go To?

Editor American Machinist:

At the works of E. C. Stearns & Co., Syracuse, N. Y., the valve stems of their Corliss engine had become badly worn, and the foreman, W. H. Craig, decided to repair them by putting sleeves over the stems and truing out the bearings in the bonnets.

As the engine was ample in size for the work, he decided to do one at a time, running the engine single-ended—blocking the port at the end where the valve was removed.

After taking out valve and stem, he had a strip of wood ½″ or so thick, fitted loosely in the port, and then a piece of board, 3½ or 4″ wide, planed to the proper curvature, and laid over the port—the small piece nailed to the large one, to keep it in place, and wedges driven in to hold it down. Wood heads with strap washers were put on in place of the washers, and the engine set running, which went along without trouble until the middle of the afternoon, when it was found hard work to supply steam enough to keep up the speed. After shutting down and removing the wood substitutes for bonnets, they failed to find the least vestige of the wedges, blocking or nails, with which the pieces were fastened together.

It is almost needless to add that he used the valve itself to cover the port while repairing the other end of the engine.

It is not at all likely that this is the first case of the kind on record, but I think it is not what would have been expected by machinists in general; and the idea of repairing the engine and still keeping the shop running is about as near "eating your cake and having it too" as one often comes.

JOHN E. SWEET.

Cutting Square Threads.

Editor American Machinist:

Here is a scheme that may help some one—you published some time ago a method of obtaining the same result—to set a tool at the proper angle for clearance in cutting a square thread. The manner in which it was accomplished in the AMERICAN MACHINIST was to center the tool and take a chip off the edges; it could then be rolled in the tool post, and upon binding it would stay firmly in position. I use a V-block—very common now a-days—for holding a variety of turning tools, with the tool of proper form filed or forged from a piece of drill rod of suitable size. I have seen some quite expensive rigs used for this purpose, and this is the simplest I know of. I have cut threads as coarse as 1″ pitch with this tool, and can't see why it can't be made stiff enough for any ordinary thread. I think it an economical tool for any kind of thread.

MACHINIST.

What is a Jig?

Editor American Machinist:

I wish to call attention of yourself or any other person among your able contributors to the need of a proper definition of that important appliance called a jig. It is not in the Century Dictionary, nor in any other work that I know of. I have never seen one, but have noticed several cuts of special ones in the AMERICAN MACHINIST. The following is my idea of the thing, which is probably defective or wrong in part, viz.:

Jig—An appliance of any size, shape or form to suit the work. It is used in the manufacture of identical or interchangeable pieces. It is attached temporarily to the work by clamps or screws, for guiding the working tool (drill, tap, file, etc.), in locating and giving direction to a hole or to a shape or size in the work.

I do not need any answer to this, but hope that some day I may see a good article in the AMERICAN MACHINIST on the subject.

ALEXANDER I. COTHEAL.

[Our idea of this matter is that it would be preferable to divide the different classes of jigs, and define them separately, under the heads of drill jig, tapping jig, filing jig, etc.

It is very difficult to make a single definition cover all kinds of jigs in a satisfactory manner. There is a difference between a drill jig and a drilling template, which Mr. Cotheal's proposed definition does not recognize. A drill jig supports, holds or incloses the work, while a template is fastened to the work and is usually supported by it.—ED.]

Cutting Bevel Gears with Spur Gear Cutters.

Editor American Machinist:

I was very much interested in the letter of Mr. A. D. Pentz, in your issue of September 10, 1891, as the parallel depth business was, to me, an entirely new phase of the bevel gear question. Shortly after reading Mr. P.'s letter I had some bevel gears to cut, and cut them by his method. They worked first-rate, although the faces were rather too short to show up the defects of the method, if any existed. While at work on this job it occurred to me that bevel gears might be cut of parallel depth with spur gear cutters if none better were at hand and the job was not so very particular. In that case the calculations would have to be made for the small ends of the teeth instead of the large ends, as is the usual practice, I believe, and while the small ends of the teeth would be all right, at the large ends they would be too shallow for their pitch. As I understand Mr. Pentz, he aims to make a tooth that is of correct shape and proportions at its midlength, and have the inner ends too deep and the outer ends too shallow for the pitches at these respective points. In Mr. Pentz's tooth the error increases each way from the midlength, while in mine it increases from the inner end towards the outer. Mr. P.'s method, of course, makes a better shaped tooth, but mine has the merit of not requiring the expense of special cutters.

In order to demonstrate whether or not this was practicable, I cut a pair of gears of 16-pitch (at the inner ends), 15 and 54 teeth respectively, and ½" face, using a rack cutter for the wheel and a cutter of right curvature for 18 teeth for the pinion. It made a fairly good job of the wheel, but the pinion did not turn out quite so well, its teeth being undercut on the inner ends for about one quarter of their length. I then tried it on a pair of 15 tooth miter gears, 16-pitch, ½" face, using a cutter suitable for 28 teeth, and in this case the undercutting was so slight as to be scarcely noticeable, from which I inferred that the method was applicable in cases where the ratio was not too high. Thinking that the undercut might be avoided somewhat in high ratios by basing the computations for pitch diameter on a slightly coarser pitch than that of the cutter used, I cut another 15 and 54-pair, and made the pitch diameter at the inner ends of the teeth correct for 15-pitch, and then used 16 pitch cutters at 16-pitch depth, which cured the undercutting completely. Had the ratio been 1 to 2, or thereabouts, 15½-pitch might have been used with advantage to determine the pitch diameter.

Mr. Pentz's method of cutting the teeth of a uniform depth throughout their length simplifies the calculations somewhat; the only thing necessary to do, as far as the angles are concerned, is to divide the number of teeth in one wheel by the number of teeth in the other, the result giving the tangent of the angle of the tops and bottoms of the teeth of the wheel used as a dividend, which is also the angle at which to turn the outer and inner ends of its mate. That is, if we divide 15 by 54 (the number of teeth in pair shown in sketch), we get .2777, which is the tangent of 15½° and a little more. As we have to guess at fractions of a degree on nearly all machine tools, we may as well call this 15½°, which is the angle at which to turn the face of pinion and the ends of teeth in wheel. The shafts being at right angles, the complement of this angle, or 74½°, will be the one at which to turn the face of wheel and ends of pinion teeth. To avoid confusion, I will say that the angles meant are those included between the parts referred to and the *axis* of gear, and not the radial face.

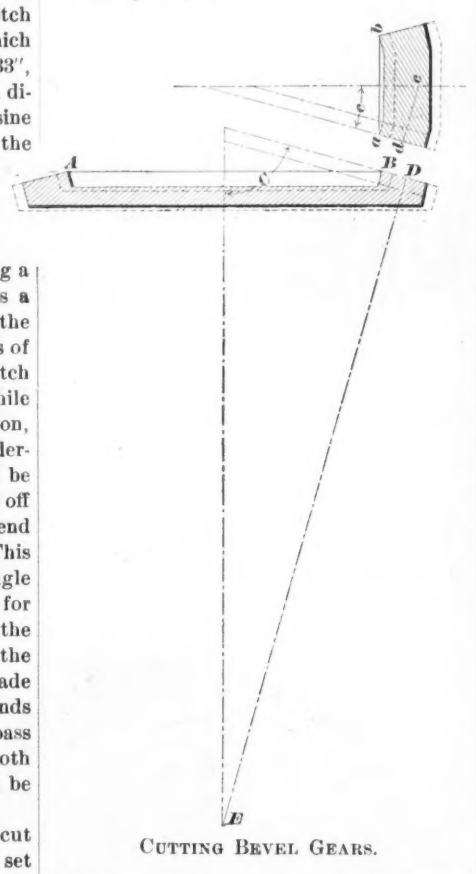
The amount to add to the pitch diameter to get the diameter at the points of the teeth at their inner ends (the distance *A B*) is found by dividing the cosine of the angle *C* by one-half of the pitch of the cutter used, which is the same process as is used to find the excess of the outside over the pitch diameter if you prefer to make your calculations for the large ends of the teeth and use bevel gear cutters. In the example in sketch we have the cosine of 74½° = .26724, which divided by 8 (one-half the pitch) gives .033", which is the amount to add to the pitch diameter of the wheel. Dividing the cosine of 15½° by 8, we get .120", which is the amount to add to the pitch diameter of pinion.

In regard to the selection of a cutter of suitable curvature, I use one that would be right for a spur wheel having a radius equal to *D E* in sketch, which is a line drawn square with the length of the teeth, from their middle point to the axis of gear. The section lined portion of sketch shows the first 15 and 54 pair I made, while the dotted outline shows the second edition, revised and improved, in which the undercutting on pinion was avoided. It will be seen that what I did, in effect, was to take off a small portion of the face at the inner end of teeth, and add it to the outer end. This did not alter the computation for angle (which depends solely on the ratio), nor for the addendum (which depends only on the pitch of cutter used), but merely made the gears slightly larger in diameter, and made the space between the teeth at the small ends a little wider, so the cutter could pass through and only finish the side of the tooth that was central. Also, the gears had to be set along the shafts a little further.

I used Brown & Sharpe cutters to cut these gears, and in setting the machine I set the cutter central at first, just as though I were going to cut a spur gear, then, by means of index dial on cross-feed, set the cutter off center to the extent of half its thickness on the pitch line, which thickness is stated in the B. & S. catalogue. After cutting around once, I set the cutter the same distance the other side of the center, gave the index a "half move," and then cut around again, which finished the wheel. In some instances it might be well to go around three times (I did on the 15-tooth miter wheels), and make a central cut to remove the slight ridge left between the two side cuts, but by making the side cuts first, it will then be easy to determine whether or not a central cut will be necessary, and if not, then you save the time of going once around. By a "half move" I mean half of the regular move to produce a given division. Thus, on the 15 tooth gear the index has to be moved 2⅔ turns each time, and, after going around once, an index move of 1⅓ turns in connection with a cross-slide movement of the thickness of the cutter on the pitch line brings the cutter back into the old cut (at the inner end), only with its other edge on the center, without any "cut and try" business at all. And this leads me to suggest that if the makers of special cutters for cutting bevel gears would mark them with their thickness at the pitch line, it would greatly facilitate setting the machine, and would be of more use to the intelligent operator than the legend, "Keep sharp."

WALTER GRIBBEN.

Brooklyn, N. Y.



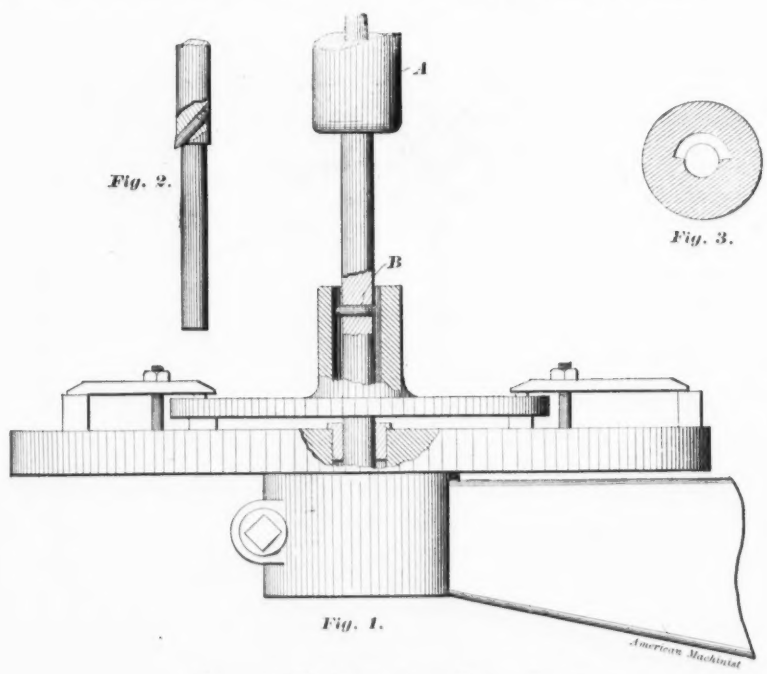
CUTTING BEVEL GEARS.

Using a Drill Press for Cutting Keyways.

Editor American Machinist:

My attention was called to this little scheme a short time ago by seeing it in use doing very good work. Although this may not be new to some of the readers of the AMERICAN MACHINIST, as it was new to me, I think it may be new to many others. I do not mean to say that this is better than a regular slotting machine for the purpose, but only, in the absence of a slotting machine, it is better than a cold chisel and file, and about as good as the planer on some jobs.

Referring to Fig. 1, there is shown a piece of work bolted to the table of the drill press, and the slotting bar in position.



CUTTING KEYWAYS WITH DRILL PRESS.

The lower end of drill spindle is supposed to be shown at *A*. The cutter, which is made of round steel, flattened on one side (not shown), so as to be held from turning by a set-screw on the side (not shown), which set-screw should be set up tight enough to hold the cutter firm, but not so tight as to prevent it being pushed ahead by a screw *B* behind it; this screw is for adjusting the cut, and for feed.

The bar is worked up and down by the handle of the lever feed, or what is called the "quick return."

In Fig. 2 I show what I think would be an improvement in making the bar. Make the bar smaller below, where the cutter goes in, so as to allow room for the chips to drop down, and then have the bar fill the hole to be slotted above the cutter. This will prevent all springing of the bar.

For a small bar I would put the cutter in at about the angle shown, so as to get a longer bearing in the bar.

There is still room for other improvements. The lower support in table can be dispensed with, and the bar made short, with the cutter inserted at about one inch from its lower end, and a good big groove cut below the cutter, to allow room for the chips to drop down.

This bar can now be made to fill the hole, and straight all the way; it cannot spring in doing its work, and is less expensive to make than either of the other ways I have shown.

In Fig. 3 I show a cross-section of a piece of work that can be done in about the same way. A piece of work of this kind can be done on a drill press in good shape by the use of a proper cutter, and after the cut is properly adjusted turn the spindle of drill press a little at the end of each up stroke for feed.

A MECHANIC.

A Handy Little Saw for Pattern Makers.

Editor American Machinist:

On pattern work where there are small spots, bosses or hubs, which come so that half of each must be attached to each part of the pattern, and these are turned up separately by attaching each half to the face-plate by the means of small brads or glued on with paper, it becomes somewhat tedious, as any pattern maker can testify, both as to the attaching and the detaching process, especially where there are a number to be done. I will now endeavor to explain a very quick method, which, while not new to all, may be of benefit to some. Take a solid block of wood, and after having sawed it plenty large on the band saw, attach it directly to the screw chuck in the lathe. Next turn it the whole length to the largest diameter of the fillet, if there be one; then, with the dividers set to the right radius, locate the center plainly, and the circumference of the face of the spot. One setting of the dividers, of course, answers for all the pieces made of the same size. Where one needs to get along with only one pair of dividers, a very quick and accurate method of locating the height or thickness of the boss is to take a little adjustable square, and set the blade the right length; hold the head of the square against the face of the spot, and with a knife-point pressed against the end of the blade, trace a line on the work. After the side is turned, quickly detach by holding a very narrow cutting-off tool against the line previously made, being careful not to get the bottom of the spot convex, but perfectly flat. After all the pieces have been turned, carefully place a saw on the center points, and halve them. Those who have followed me thus far will probably say, "But you are taking out stock, and your spot will no longer be a circle, but an ellipse." This is just the point I want to get at, and I will try to explain myself. A nice saw for this purpose is a little machinist's hack saw, with a very thin six-inch blade. These blades can be procured in hardware stores in stiff wire frames, and are only about two one-hundredths of an inch in thickness, and cost, complete with frame, about thirty-five or forty cents. They have very fine teeth, and will cut wood very smoothly indeed, and, being so cheap, they are not intended to be filed, but replaced with new ones when dull. These saws remove so little stock that it will make no appreciable difference on ordinary jobs, and for very nice work it is a good idea to make the blades thinner yet, in the following manner: Put the blade into the frame, and then hold over a moderately fine emery wheel, drawing it back

and forth, so that the flat part of the blade shall rest evenly against the wheel. Be careful not to draw the temper, and be sure to have the back thinner than where the teeth are, so that it will not bind in the work. By using one of these saws, very small pieces can be halved, and the difference in diameter will be so slight that it will not be discovered, or even thought of, unless one is told.

JOHN M. RICHARDSON.

Atomizer.

Editor American Machinist:

The writer says in the last issue of the AMERICAN MACHINIST that Mr. H. L. Reynolds wanted an instrument to blow a fine spray some four feet or more—an atomizer.

Some twelve years since the writer made a small affair to blow sour beer or returns from rum distilleries (where molasses was used) on molds after they were blacked, to hold the blacking from working. I see they are now very generally used to blow liquid. Cigar makers, etc., use them.

Description: *A*, a brass tube $\frac{3}{8}$" inside diameter, some 7" long, for the blow pipe, and *B* same size pipe placed at right angles. Please note the position at ends of tubes, that the tube *B* is a trifle above the lower edge of *A* and $\frac{1}{16}$" away. By experiment it was found the best results were obtained when these positions were secured, by the brass plate *C* being soldered to both tubes These are blown by the mouth of the operator. I do not know the pressure required, but suppose larger pipes would require more than the small ones, and could be blown by blast if desired.

By keeping the tubes apart, as shown at *, finer spray is produced.

He can obtain one of these atomizers from any cigar manufacturer; these are small, but they show the principle. X. Y.

Blue Print Frames and Drawings.

Editor American Machinist:

In looking over your Question and Answer column I noticed that some one asked for information about blue print frames and the size of drawings, and I thought the occasion a good one in which to put in my oar.

I have in my time made several blue print frames, and of drawings I have made several times that many. I have made drawings on sheets all the way from 3x3" up to 5 x12"; but these I made without any choice in the matter of size.

In the days before Weston's linen record paper 27x40" sheets came into use for drawing on, my favorite-sized sheet was a 28x40", largest size, and subdivided into 20x28, 14x 20, 10x14".

These sizes I found very convenient for general machine work; but I could find none of these sized sheets ready cut in the market, and if I wanted them cut I either had to pay extra for the cutting or buy roll paper 56" wide, and cut them myself, which I usually did.

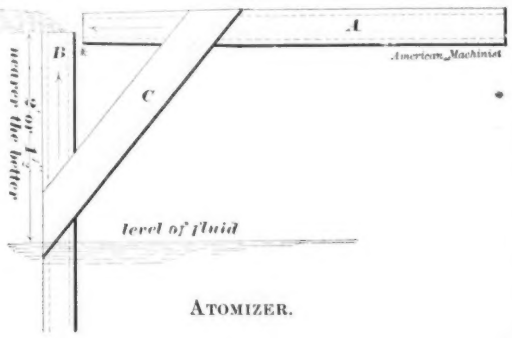
When I found the linen record paper I stopped buying roll paper and bought this kind, as it comes already cut in sheets 27x 40", and is in every way preferable to most white papers to make pencil drawings on, and where pencil drawings only are made to trace from, white paper is by far the best, as it saves any difference in cost in the wear and tear of eyes. Now the sizes obtained by subdividing the 27x40" sheet would be 20x 27, 13½x20, and 10x13½".

These all make very nice sized sheets, and I have found 27x40" large enough for any work I have had to do. On this size sheet I have made the general plan of a steel works, which required the space of 400x 3,000'. I have also made on this size sheet the plans and details of one of the largest coal breakers in the Wyoming region, and I found it just as convenient on which to make the plans for a boiler, a pair of hoisting engines, a hydraulic press, or a paper bag machine.

This, of course, is for general plans, or assembled drawings, but I have also made details on this largest size; but, as you say, I have found the smallest sheet—10x13½"—the most convenient for handling in the shop. I also found the 13½x20" a very convenient sheet on which to make detail drawings.

Now as to the printing frame. I have found that illustrated in the accompanying drawings a very convenient arrangement—two inches margin around the sheet is sufficient for all practical purposes.

I usually make my clear opening in the frame for a 27x40" sheet 31x44". I get the piece of glass 28x41x$\frac{3}{8}$" thick, and the frame is made as shown in the drawing, of which Fig. 1 is a side elevation of the frame pushed about half way out of the window. Fig. 2 is a section of the frame showing how the glass is held in place.



ATOMIZER.

In Fig. 1 *a* is the bottom board, on top of which is fixed a cushion *B*. To make this cushion I usually take four large rolls of cotton batting and lay on the board. This I cover with unbleached muslin and tack it directly to the board, making the cushion a little higher on the inside end, and leaving a margin of about an inch in from the edge around two sides, and the inside end of the board.

The board should be made out of $\frac{7}{8}$ stuff, 37x50". To the under side of the board, and a little inside of the center, is fixed an angle *h*, with two grooved wheels *g*. The grooves in the wheels are made so they will fit easily over $\frac{3}{4}$ square iron of which the tracks *i* are made. Of course tracks made of any other shape iron will answer just as well. I have found the above easy to make and about as cheap, as well as strong, as any other, and ornamental enough. To the outside end of the board is fixed a piece of wood *n*, a little less than the thickness of the cushion at that end and two inches wide; length the width of the board. To this the glass frame *d* is hinged; the glass frame is made of 1½x 3" stuff; the inside is beveled down to about $\frac{5}{8}$" thick; the under side is rabbeted out $\frac{3}{8}$" deep by $\frac{1}{16}$" wide, into which the glass fits loosely. The glass *c* is held in place in the frame by $\frac{1}{16}$x1" strap-iron *f* screwed to the frame. This construction permits the glass to come down onto the cushion so that its whole surface bears thereon with sufficient pressure to keep the tracing and the paper smooth, and in contact over its entire surface. Two props *E* are hinged to the board *a* by the side of the cushion; these are for holding up the frame *d* while the tracing and paper are being put in or taken out.

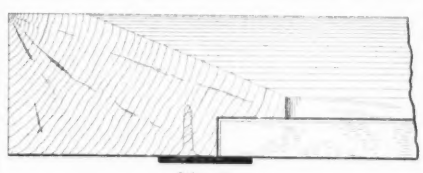


Fig. 2.

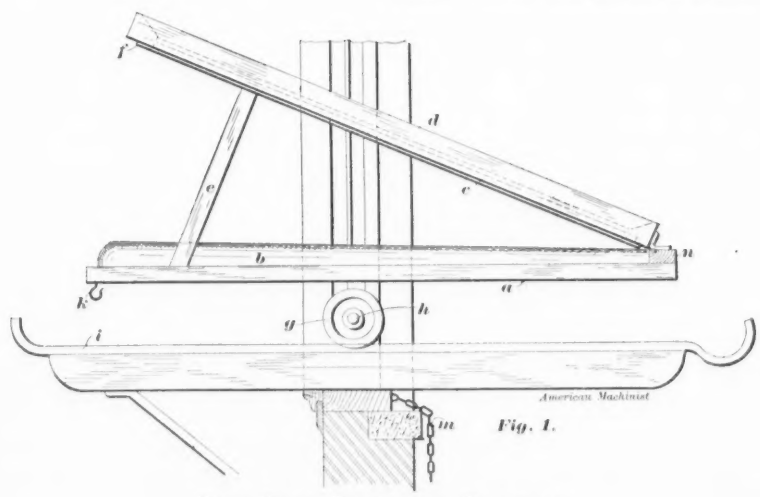


Fig. 1.

BLUE PRINT FRAME AND DRAWINGS.

You will see this makes a very handy blue print frame; you just lift up your frame *d* at the inner end, put up your props, lay on your paper and tracing, let your glass down on them, shove her out, tip her up to the best angle for light, hook the chain *m* onto the hook *k* to hold her in position, and let her print. There is no locking or clamping of the frame, or turning it over, or hoisting it up.

The track need not project outside of the building only a little more than half the length of the board. GEORGE GUNTZ.

About Steel.

Editor American Machinist:

I know of no other thing that there are so many vague ideas about as there are in hardening steel. You ask a question of most blacksmiths about hardening steel and they will give you a very knowing look, and this is all they will give you.

My father is an old-time blacksmith, and has been successful in working and tempering steel. The point that he was most particular about, and the point that he considered the most important in hardening, was in heating the work.

He would never use a fierce fire, as he would in getting a welding heat upon a piece of iron, and he never hurried, but heated the work very slowly and kept it continually in motion, and managed to get a very even heat and just the proper heat to harden well and *not too hot*. I believe that many times when work cracks in hardening, or just after, it is caused by the work being heated too quickly, and so not evenly. A common blacksmith's fire is not the best place in the world to heat a large piece of work for hardening; but when there is nothing better to be had, all the kinks that will tend to make the job more certain are worth knowing.

A good deep fire is needed, so as to have plenty of coal between the work and the blast. When a small portable forge has to be used, it can be improved for the purpose by putting on an extra guard of sheet iron, so as to keep the coal from dropping off, and then a deep fire can be had. Charcoal is better than soft coal, for it does not give such a fierce heat. The fire should be well burned up before the steel is put in, and the blast should not be heavy. To think that anybody can manage a fire properly to harden a large piece of steel is to think wrong. To do this properly requires practice. The lowest heat that will harden the work is the proper heat. Of course there are different degrees of hardness, but for hardening in the ordinary way, work is called hard when a good file will make no impression upon it.

When I am not sure of the proper heat I always try to be on the safe side and heat very low, and then if it does not harden I heat next time a little hotter; but very little, for I find that it is a fine point.

Scientists do not hesitate to tell us the amount of heat in degrees that is needed to melt iron and other metals, but they do not show us a practical pyrometer by which we can determine the temperature of a hardening bath that is much lower than the melting point of iron. I believe that this could be something that could be used to good advantage. If we had a pyrometer that would bear constant service and remain as accurate as a common thermometer, that we could put into a hardening bath, and know its heat in degrees without the uncertain way of judging by the color, we would have made a step in the right direction.

We could then talk about using steel of the proper grade for the purpose, and heating it to the proper heat and hardening without drawing the temper, but now—well, we can talk about doing this, I suppose.

Can anybody tell just why a salt brine is used by many for a cooling bath?

My father always used a salt brine, and told me that it tended to prevent "fire cracks." I believe that a large piece of steel can sometimes be saved by taking it out of the water before it is quite cool and drawing the temper right away, for when there are strains that almost break the work, a very little extra may break it, just as the last straw broke the camel's back.

These strains can be prevented to quite an extent by properly heating the work.

There are forms that steel can be made into that are practically impossible to harden without cracking, and in such a case it is better to spend time in designing some other thing for the purpose than to try to harden it.

I saw in the AMERICAN MACHINIST some time ago a plan for a hardening bath of lead. In my work I ran across by accident a way of having a lead bath so that the lead would not waste away much, and without covering its surface. It is to have a deep vessel for the bath, so that the top acts as a tall chimney, and I suppose that the air inside is heated so hot that its power of oxidizing is partly gone. Whatever the reason may be, that thick scum does not come upon the surface.

After a piece of steel is hardened it often has to be straightened.

Now there are people who say that a piece of hardened steel can be straightened without starting the temper at all, but I never saw it done, and don't think it can be done.

To straighten a piece of hardened steel, the bending must be done while the temper is running. Suppose we have a long reamer to straighten: we polish it just as we would to show a good color in drawing, and then we heat it to draw the temper; and while the temper is running, after it starts and before it comes to the proper color, all straightening must be done. It is no use to try to make the work take a permanent set before the temper starts. I have straightened a taper reamer 24" long on the cut, $\frac{1}{16}$ in 12 taper, and 1¼" diameter at large end, with taper shank about 6" long, with $\frac{1}{64}$" allowed for grinding, where it ran out of true after hardening ¼", so that it finished true.

A MECHANIC.

Ball Bearings.

Editor American Machinist:

I have to construct a train of spur gears, the pitches of which are Nos. 12, 15, 18, 24. The train runs very slow, but I must reduce friction to a minimum.

I should now like to ask the advisability of using ball bearings for the journals. Will some of your readers who are in a position to know some facts pertaining to this matter favor me by expressing themselves?

A. N. J.

Cementing Belts.

Editor American Machinist:

In addition to the answer which you give H. M. C, No. 36, same issue, about cementing belts, I have found as an extra good precaution to secure a good, safe, tight job, is to use a liberal supply of shoe-pegs driven all over the lap. Ordinarily, belts which have been in use are somewhat greasy, which precludes the best results in gluing; therefore I find the pegs serve to hold the joint better.

L. C. SHARP.

AMERICAN MACHINIST

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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The Limitations of the Molding Machine.

A friend who is a prominent mechanic, and has had considerable experience with molding machines, thinks we did not do these machines full justice in our remarks under the head of "Machinery and Intelligent Labor," issue of Feb. 11. He says:

"If you were to go into a steel foundry you would find that knuckles for the M. C. B. standard vertical plane coupler, crossheads and pistons for locomotives, gears, crankshafts for steam engines, etc., are done by the best molders. In shafting establishments, hangers are considered good work, and in a general shop, engine cylinders and castings are the best. Molding machines are making all these with the best results." He mentions other work which is done upon the machine—brass castings for sight-feed lubricators, gate valves, check valves, etc., and says: "In fact, machine molding pays best when applied to the more expensive hand work."

Upon looking over our words again, we perceive that we did not clearly express the precise idea we had in mind at the time, and we can therefore hardly blame our friend for misunderstanding the tenor of our remarks to some extent. With all due deference to him, we do not think that the classes of work mentioned by him constitute the best work that the molder is called upon to do. At least they are not the kinds of work we had in mind at the time. In a former article we pointed out that work in the machine shop, which was done for the first time, and where the mechanic who did it had therefore to choose his methods, and use his judgment and skill in doing it, might be the best work, and require to be done by the best workman, while the very same pieces of work, when afterwards made by the hundred by cut-and-dried methods requiring little or no exercise of judgment or skill, might become among the very poorest work, and, in fact, that it often happened that good mechanics would not work on such duplicated pieces, even if it were desirable to have them do so.

A really great picture can be painted only by a great artist; but after such a picture is painted a very ordinary artist can reproduce it, and, in fact, very good reproductions can be made by purely mechanical methods, or, in other words, by machinery. No real artist would be content to spend his life in copying the pictures of others, and if he did so spend his time he would not expect to receive such compensation as that obtained by the painters of the originals.

To a great extent, the same principles apply in molding. When the first engine of a certain kind is to be made, it certainly pays, and we believe it always will pay, to give the job to a first class molder, for the simple reason that judgment and skill are necessarily to be used in making it. But afterward, when it is found that this engine is to be made in sufficient numbers to make it pay to put in a molding machine to make the cylinders, then by that time the job of molding those cylinders has become simply a monotonous repetition of the same operations over and over again, all the problems involved in the case having been solved during the making of the first few, or the first dozen or so.

When this point is reached, a really first-class molder will prefer to do something else having more variety, and giving him more opportunity for the exercise of the skill which he possesses, and which he wishes to be paid for. Stated broadly, our position is that there will always be a large class of work which will require the use of brains to properly perform it. To this category belongs all or nearly all loam molding, and all work which is done for the first time, or of which only a few pieces are to be made alike. Machines never can do this work. On the other hand there is a large class of work which can be done, after the method is established, without the use of brains to any great extent. To this category belong all or nearly all pieces which are made in great numbers exactly alike. Here the machine will come into use, and we sincerely believe it will be a good thing for the molder and his trade that it will come into use in this field.

Designing for the Operator.

We think it will be conceded by most of those who stop to think of the matter, that any designer who is designing a machine which is to be operated by a human being should consider, among the most important features of it, the comfort and convenience of the operator. An operator who is comfortable, can, other things being equal, do much more work and much better work than one who is uncomfortable, and it should always be remembered that this question of the comfort or the discomfort of an operator depends largely upon the position which he is obliged to assume while operating the machine. For instance, there is no doubt upon the part of those who have had experience in the matter, that certain operations of machine tending or operating are better and more expeditiously performed when the operator is in a sitting position, while in other operations such a position would be uncomfortable and would interfere with the work; and, where possible, the designer should consider these points. In other cases it may be advisable to so design a machine, if possible, that the operator may stand or sit, as suits him best. If anything is to make an operator experience a feeling of fatigue, it should be the work done, and nothing else, and where the position necessary to be assumed is of itself sufficient to cause fatigue before the day's work is over, a correspondingly less quantity of work may be looked for, and probably, also, a falling off in quality, if the work is of such nature that fatigue can cause deterioration in quality.

It would be a good plan, we think, if every designer of machinery would place himself in the position which the operator of his proposed machine will necessarily assume, and note whether or not it is a natural and easy one, and whether it could probably be held during an entire day without serious fatigue.

Especially where machinery is to be used by young persons we think it is important that this matter should receive attention, for any unnatural or strained position assumed by a growing person for any length of time cannot fail to be a permanent injury to such person. We are reminded of this by seeing in some of our contemporaries a short time since an illustration of a small drill press intended for use mainly in light manufacturing operations. Of course this press will be used almost exclusively by growing boys, and the design is such that the boy who operates it will have to sit with his knees close together, and by pressing them upwards raise the table and thus feed the drill, leaving his hands free to handle the work. Now any one who stops to think for a single moment must know that such a position and such a way of feeding a drill would simply become a torture to most boys long before night, and that it would be simply impossible for any boy to sit steadily at the machine and keep it going all day, as he could if he had an opportunity to shift his legs about and change his position occasionally to rest himself without stopping the machine. We happen to know that the designer of this drill is an excellent mechanic and a skilled engineer; he simply overlooked this point in this instance, and we think thereby made a mistake. Machines should be designed for the operator as well as for the work, and it is owing to the fact that American machinery has usually been designed with a view to the convenience and comfort of the operator that it has become pre-eminent in many lines.

Another feature of the case is that it is important to a builder of machinery that those who are to operate it shall be pleased with it, and shall believe that it is the best machinery of its kind, and they are most apt to believe this of a machine with which they experience some degree of comfort in operating. Many locomotives have not done as well on the road as they were expected to do, and should have done, because things had not been arranged in the cab with a view to the convenience, comfort and safety of the engineer and fireman.

George Worthington.

Mr. George Worthington, founder and for nine years editor of the *Electrical Review*, died February 3d at the home of his brother, in Buffalo. By his death electrical interests lose a valuable friend, his influence having been potent for good in many ways in connection with the development of electricity. He took a prominent part in the founding of the American Institute of Electrical Engineers, the National Electric Light Association, and the New York Electric Club, spending his time and his money freely to advance their interests.

Personally Mr. Worthington was very popular, for he possessed those qualities of mind and heart which endeared him to those with whom he was associated.

The consolidation of competing companies goes on steadily, among the latest being the combination of the leading coal-carrying roads, also of the Edison and Thomson-Houston Electric Companies, with a rumor that they will be joined in the near future by the Westinghouse Co.

In the case of the electric companies, at least, it is probable that there will be sufficient competition from outside and independent companies to prevent any very serious impediment to the development of electricity by the combination; but in the case of the coal roads, things seem to have been put into such shape that it will be possible at least to exact from the consumers of anthracite coal the last cent which it is possible for them to pay for it—the only circumstance which seems at all likely to keep the price within reasonable bounds being the fact that for most purposes for which anthracite is now used, bituminous coal can be substituted if necessary.

One of the most important dispatches recently published in the daily press has been one giving the outcome of some investigations made by the wife of one of the cabinet officers. It seems that she had been in doubt as to whether the President should occupy the place of the host at the head of the table, when invited to a dinner at her house, and in order to ascertain the correct thing on this point, she corresponded with those supposed to know all about it in England, besides conferring with experts on etiquette in this country, the result being that the President occupied the place usually assigned to the host. Of course our readers will all be very much pleased to know that this important question has been definitely settled, and the country may now rest easy for a time, while the rest of us skirmish around for the wherewithal to buy our dinners.

Some very ugly stories have been published regarding the treatment of men hired in this city to work on the new railroad in the Adirondack wilderness. It is stated that men were engaged in New York and promised wages of $1.25 a day. When they arrived at their destination, they found that the company had charged them $12 for transportation; that everything which they needed to subsist upon could be bought only of the company at highly inflated prices. It was found in some cases that after the men had worked for a month, instead of being anything ahead they were in debt to the company. The treatment given them caused some of them to run away, and as they had no money or other resources, they, of course, were obliged to become tramps until they could find something else to do.

It seems to us that Typographical Union, No. 6, of this city, has taken about the right course with regard to what might be called the invasion of their trade by machinery. At a recent meeting of the Union, after con-

siderable discussion of this matter, it was resolved to form a school under the direction of the Union, in which members will be taught to become machine experts. This action indicates that the members clearly see that the introduction of machinery cannot be profitably opposed, and that they propose to take the bull by the horns, and appropriate to themselves as much of the advantage resulting from its introduction as possible.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(70) J. H., Clinton, Mass., writes: Please let me know through your columns if I can get drawings of the steel twin-screw vessel for the Quartermaster's Department, U. S. N. You have given illustrations of it in your issue of July 23, 1891, but I would like to have drawings of the deck fittings, the boats she carries, and her rigging. *A.*—Write to the builder, Mr. H. Dialogue, Camden, N. J.

(71) O. S., Rockwood, Tenn., writes: Please answer through your columns the following question: Is it correct to put a globe valve in a steam pipe, connecting the engine to boiler, with the pressure on top of the valve? There is a gentleman here who claims to be quite a mechanic, and says the pressure should be on top. I say it should be on the bottom of the valve. I have been thirty-nine years in the business, and I never put a valve in with the pressure on top, and I think I have the best of reasons for it. *A.*—The pressure should be on top of the valve, so as to relieve the thread on the spindle of pressure as much as possible. The advantage of this is that, when the valve is closed, there will be no danger of it flying open, as might be the case when the pressure is on the bottom of the valve, and the thread on spindle strip off. Particularly in a battery of boilers we should always have the pressure on top of the valve, so that when one boiler is shut off for repairs and cleaning, while the other boilers are under pressure, the life of a man will not depend on the thread of the screw.

(72) C. F. W., Cambridge, Mass., writes: I have some bars of Jessop's cast-steel, 2″x 1″, to be cut into short pieces. On putting them on the planer I was surprised to find it impossible to cut them, as they tore the tool all to pieces. I put one of the pieces into a lathe, and found no great trouble in cutting it off. I also found that it would plane all right lengthwise, and that when a piece was cut off in the blacksmith shop I could true the ends up in the planer all right, but was still unable to use a cutting-off tool on it anywhere. Have tried several different steels for tools, but get no better results. Can you explain the cause or give a remedy for the trouble? *A.*—We cannot give the cause of the trouble, because it may be any one of several different things. Stated broadly: We should be inclined to say that there is some peculiar condition which a good mechanic ought to be able to perceive and remove, because there is no possible reason that we can imagine why it should be easy to work a good bar of steel in any other way in the planer or in the lathe, and yet be unable to cut it off with a parting tool. If the tool is properly made, if the bars are securely held upon the platen so that they cannot spring, if lard oil is used upon the tool, and the planer is not overspeeded for that work, we should confidently expect to succeed in cutting off the bars, if they are in such condition as to be worked in other ways.

(73) P. L., Fitchburg, Mass., writes: Please let me know if the solution of the following problem is correct. A belt is hung over a fixed pulley, a 100-pound weight is attached to one end of the belt, and a weight of 130 pounds is attached to the other end, the extra thirty pounds being sufficient to balance the resistance of friction. Now the pressure on the bearings I compute to be $100 + 130 = 230$ pounds. *A.*—This pressure is correct for the weights attached to the belt; for the total weight on the bearings, add the weight of the pulley, shaft and belt. 2. Please explain how to compute the pressure in pounds on the bearings due to the transmission of 20 horse-power, by a belt running in a horizontal direction, at a speed of 3,300 feet per minute. *A.*—An exact computation of the pressure on the bearing to suit all conditions will involve complicated formulas. The following simple method, based on rules given in Prof. Unwin's Machine Design, will give results sufficiently accurate for all ordinary cases. In a great many cases in practice the belt embraces about 0.4 of the pulley on which it is most liable to slip, that is, the pulley having the smaller arc of contact, and the coefficient of friction is at least 0.3. When this is the case, the driving force is found by the following formula:

$$P = \frac{550 \times H}{V}$$

in which P denotes the driving force in pounds, H the horse-power transmitted, and V the velocity of the belt in feet per second. The pressure on the bearings due to the transmission of power may be taken as three times the driving force P. Now the velocity in feet per second of the belt, as given in the example, is $\frac{3,300}{60} = 55$; the driving force P will be

$$P = \frac{550 \times 20}{55} = 200 \text{ pounds},$$

and the pressure on the bearings will be $200 \times 3 = 600$ pounds. Of course this pressure is that due to the transmission of the power only, and does not include the weight of pulley, shaft and belt. If there are several pulleys on the shaft, and power transmitted by belts running in different directions, the pressure as computed above will have to be modified.

(74) R. D., Habana, Cuba, writes: I have inclosed a sketch of a jet condenser, such as is generally used here in sugar factories. Please give me the information in regard to it, as asked below, and formula Suppose there is a vacuum of 25 inches in the condenser, how many gallons of water (U. S.) per minute will be drawn through a 6-inch pipe into the condenser? *A.*—The first step will be to find the velocity head. The vacuum is 25 inches, which means that the vapor in the condenser will balance 5 inches of mercury. The atmosphere will balance 30 inches of mercury, hence we have $30 - 5 = 25$ inches of mercury unbalanced, which is equal to a pressure of $\frac{25}{30} \times 14.7 = 12.25$ pounds per square inch. Each pound per square inch corresponds to a head of 2.304 feet, hence the head, corresponding to a pressure of 12.25 pounds, is $12.25 \times 2\ 304 = 28.22$ feet. The water, according to your sketch, has to be lifted through a height of 7 feet, which leaves $28.22 - 7 = 21.22$ feet (say 21 feet), for the velocity head. Now, using the formula given in answer to Question 21, in our issue of January 14, we have for the velocity

$$v = \sqrt{\frac{64.4 \times h}{1.5 + f\frac{l}{d}}}$$

in which h denotes the head in feet; l the length of the pipe in feet, which, according to sketch, is 8 feet; d the diameter of the pipe in feet; and f a friction factor, whose value in this case will be .016. Substituting for the symbols their values, we have

$$v = \sqrt{\frac{64.4 \times 21}{1.5 + .016 \times \frac{8}{.5}}} = 27 \text{ feet}.$$

Multiplying this velocity by the cross-sectional area of the pipe in square feet, we obtain the discharge per second, which is equal to $27 \times .196 = 5.292$ cubic feet per second; and per minute, $5\ 292 \times 60 = 317.52$ cubic feet. One cubic foot is equal to 7.481 U. S. gallons, hence the discharge per minute will be $317.52 \times 7.481 = 2,365.37$ gallons. We notice that the water has to pass through a strainer in the condenser; this will reduce the above quantity at least 25 per cent. We have not sufficient data to answer your second question; you do not state the amount of heat absorbed, or the kind of liquor to be heated. The information you require is best obtained by experiment.

(75) W. E. C., Brooklyn, N. Y., asks: To whom should an application be made for admission to the United States Naval Academy? I have worked in a machine shop three years and have a thorough school education. I am 18 years of age. What will be the cost of an apprenticeship there? *A.*—We have a number of similar inquiries, and in answer to them all we give the following quotations from the published regulations governing the admission of candidates into the Naval Academy as cadets. There shall be allowed at the Academy one naval cadet for every member or delegate of the House of Representatives, one for the District of Columbia, and ten at large, provided, however, that there shall not be at any time more in the Academy appointed at large than ten. The course of naval cadets is six years—four years at the Academy and two years at sea, at the expiration of which time the cadet returns to the Academy for final graduation, and the district then becomes vacant. Appointments to fill all vacancies that may occur during a year in the lower grades of the line and engineer corps of the navy and of the marine corps will be made from the naval cadets, graduates of the year, at the conclusion of their six years' course, in order of merit as determined by the Academic Board of the Naval Academy. At least fifteen appointments from such graduates will be made each year. Surplus graduates who do not receive such appointments will be given a certificate of graduation, an honorable discharge, and one year's sea pay, as provided for naval cadets. The nomination of a candidate as cadet to fill a vacancy shall be made upon the recommendation of the member or delegate, if such recommendation is made by the first day of July of that year; but if it is not made by that time the Secretary of the Navy shall fill the vacancy. The candidate for the District of Columbia and all the candidates appointed at large shall be selected by the President. Candidates allowed for congressional districts, for territories, and for the District of Columbia, must be actual residents of the districts or territories respectively from which they are nominated, and all candidates must, at the time of their examination for admission, be between the ages of fifteen and twenty years, and physically sound, well formed, and of robust constitution. All candidates for admission into the Academy shall be examined according to such regulations and at such stated times as the Secretary of the Navy may prescribe. The general character of the examination is: Candidates must be able to read understandingly and with proper accent and emphasis, and to write legibly, neatly and rapidly. They must be able to write from dictation, paragraphs from standard pieces of English literature, both prose and poetry, sufficient in number to test fully their qualifications in this branch. The spelling throughout the examination will be considered in marking the papers. The candidate will be required to express in figures any whole decimal or mixed number; to write in words any given number; to perform with facility and accuracy the various operations of addition, subtraction, multiplication and division of whole numbers, whether abstract or compound, and to use with facility the tables of money, weights and measures in common use, including English money. To reduce compound numbers from one denomination to another, and to express them as decimals or fractions of a higher or lower denomination; to define prime and composite numbers; to give tests of divisibility by 3, 5, 7, 9, 11, 25, 125; to be familiar with all the processes of common and decimal fractions, and to give clearly the reason for such processes, and to be able to use the contracted methods of multiplication and division given in the ordinary text-books on arithmetic; to define ratio and proportion, and to solve problems in simple and compound proportion; to solve problems involving the measurement of rectangular surfaces and solids; to find the square and cube roots of numbers, and to solve simple problems under percentage, interest and discount. The candidates are required to possess such a thorough understanding of all the fundamental operations of arithmetic as will enable them to apply the various principles to the solution of any complex problem which can be solved by the methods of arithmetic. The examination in algebra will be elementary in character, and will be limited to questions and problems upon the fundamental rules, factoring, algebraic fractions, and simple equations of one or more unknown quantities. In English grammar candidates must exhibit a familiarity with all the parts of speech and the rules in relation thereto; must be able to parse any ordinary sentence given to them, and generally must understand those portions of the subject usually taught and comprehended under the heads of orthography, etymology and syntax. Candidates will be required to pass a satisfactory examination, written or oral, or both, in descriptive geography, particularly of our own country. The candidate's knowledge of the geography of the United States cannot be too full or specific. Accurate knowledge will also be required of the positions of the country with reference to other States, and with reference to latitude and longitude; of the boundaries and relative position of the States and Territories, and of the name and position of their capitals, and of other important cities and towns. Candidates should be familiar with so much of the history of the United States as is contained in the ordinary school histories. Candidates that pass the physical and mental examinations will receive appointments as naval cadets, and become students of the Academy. Each cadet will be required to sign articles by which he binds himself to serve in the United States Navy eight years (including his time of probation at the Naval Academy) unless sooner discharged. The pay of a naval cadet is $500 a year, commencing at the date of his admission. The cadets will supply themselves, immediately after their admission, with prescribed clothing and other articles, costing $171.12. Each naval cadet must on admission deposit with the pay officer the sum of $20, for which he will be credited on the books of that officer, to be expended by direction of superintendent in the purchase of text-books and other authorized articles. All deposits for clothing and the entrance deposit of $20 must be made before a candidate can be received into the Academy.

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"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Molding of Guns, Hydraulic Cylinders, Etc.

BY S. BOLLAND.

When hydraulic cylinders, rams, shafting, pipes, guns, etc., become so ponderous and unwieldy as to make it impracticable to mold them in top and bottom flasks, recourse is usually had to the method of casings, made to the form of the job for which they are intended, these being prepared for casting either by ramming sand in them—using a pattern to be drawn out endwise—or by "striking" on the inner surface a thickness of loam, using a spindle and sweep for that purpose.

As the latter method comes under the head of "loam molding," we shall pass it over and consider only such as are made in dry sand; and as one good example taken in detail will serve to bring out most, if not all of the principles involved in the production of this class of work, we will take for such an example a Rodman gun, about 16 inches bore and 16 feet long, exclusive of sinking head, which we will suppose to be about 3 feet long.

To effect an equal cooling of the whole mass, when cast, a stream of cold water is introduced into the barrel, through the top at *A*, Fig. 33, passing downwards to near

the bottom of the core barrel through a pipe inserted for the purpose, and again rising up, filling the space between the pipe and the barrel; escaping at *B*.

The water is forced through at a pressure sufficient to enable it to carry off the heat as fast as it escapes from the casting, thus enabling those in charge to regulate the cooling of the gun, so as to preserve an even grain throughout the mass, with comparative freedom from fracture; something it is next to impossible to do by any other known method.

Fuller details of the device for introducing the water into the barrel are shown at Fig. 34.

Fig. 33 is a sectional elevation of the whole mold and flasks, as it stands in the pit ready to receive the molten iron; by referring to enlarged plan of same, Fig. 35, it will be seen that the section is taken at the points *A* and *A*, thus revealing the position of the running gates, the lowest of which must be set to give a rotary motion to the molten iron.

If these bottom gates are made large enough, sufficient force will be given by them to keep the iron revolving round the core until it has passed the trunnions, and by this means preventing the dirt from finding a lodgment there; the upper gates augment the speed of the pouring, which perceptily slackens as the mold fills, and also serve the purpose of keeping the iron in good condition at the top all through the cast—something very desirable when we remember how clean such a casting must be.

Fig. 36 shows full length section of mold at the trunnion side, and also aids the reader in arriving at a full knowledge of the whole set of flasks or casings used.

As shown at Fig. 36, and again in plan at Fig. 35, the handling of these flasks is accomplished by slings which are made to fit the swivels seen.

That section which contains the trunnion calls for special mention, inasmuch as the trunnion pierces the casing which is there strengthened by forming a circular box or pocket with an outer flange; this, of course, must be cast in one piece with the casing for that section.

This pocket must be true to position, with a slight taper, to receive the trunnion core when the casing is rammed; over this, a strong plate with swivel attached is bolted; this, as will readily be observed, allows of this section being handled in the same manner as the rest.

No one without some knowledge of pressures and the strength of materials should attempt to prepare the apparatus needed for the construction of a job like this without first consulting some one acquainted with such subjects. Disasters are happening every day on this account, and men ought to learn from bitter experience the necessity for more knowledge upon matters so important.

These flasks should be 1½ inches thick at the bottom and 1 inch thick at the top, with flanges and ribs corresponding to thickness of sides, and all flanges should be wide enough to allow of 1 inch of iron outside the bolt holes.

As shown, these castings are made in halves, parting at *A A*, Fig. 35. When made they must be bolted firmly together and turned at the ends so that they will not only fit each other true, but will also fit the face-plate shown at *A A*, Fig. 37.

This plate is turned and prepared as shown, for the purpose of receiving the pattern, flask and gate pins of all the sections.

Fig. 37 is intended to explain the manner of changing for each section; the reader will be helped very much by observing the plan view of the same at Fig. 38; on the left hand of Fig. 37 it will be seen that the pattern is set for the smallest or "head section." These patterns are cast-iron, turned to size, and fitted with bottom guides to fit face-plate, as seen at *C*, which is turned to receive the same.

This being the smallest piece, the gate pin is guided by the inside hole at *D*, and the flask is held in position by the shoulder at *E*.

To form the molds in the other flasks on the same face plate and with equal facility and correctness, rings *F* and *G*—also turned to fit—are set on respectively, and the operation duplicated.

The right hand view shows these rings in position, and the flask for the breach set thereon and rammed; this, of course, is the largest in diameter; flask *H* is seen over the edge of the outer ring, the gate pin *I* occupying the outer hole.

The bottom section of this mold may be rammed over a face-board and pattern, or struck with spindle and sweep, or any other suitable guide way.

Fig. 35

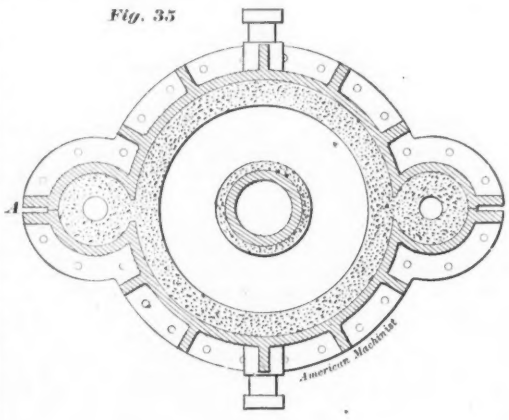


Fig. 33.

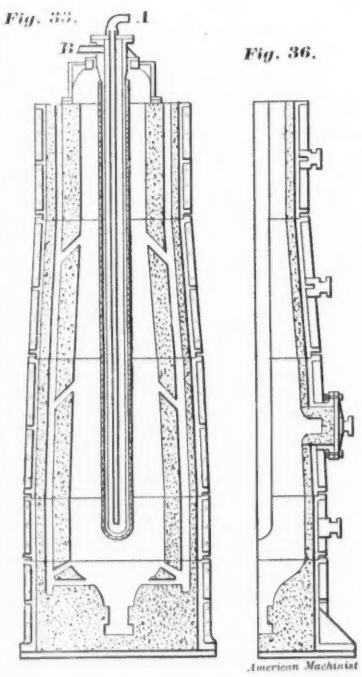


Fig. 36.

Fig. 42.

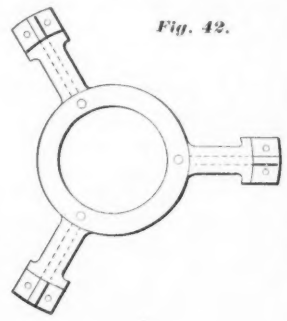


Fig. 34.

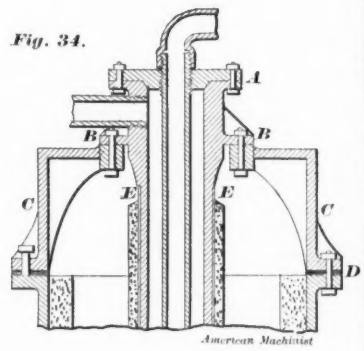
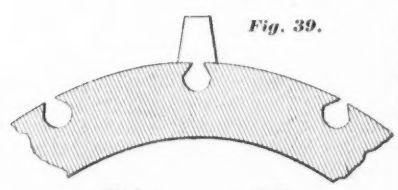


Fig. 39.



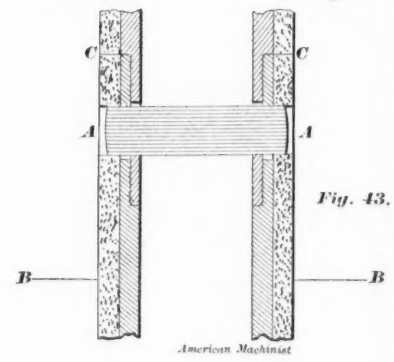


Fig. 43.

Fig. 40.

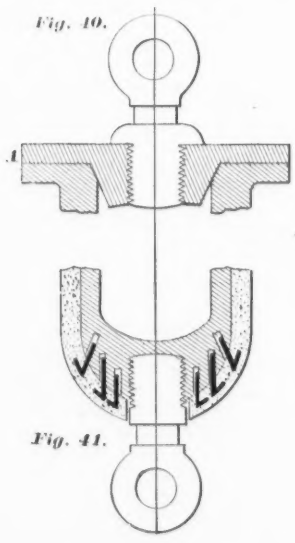


Fig. 41.

Fig. 37.

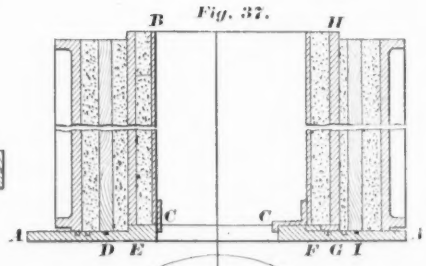
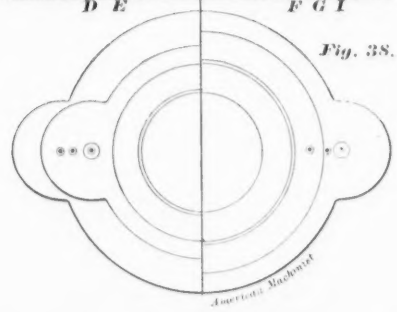


Fig. 38.



A set of castings, got up after the design just explained, eradicates all the difficulties in obtaining a true mold, as molds having a vertical height of thirty-five feet may be made in them, with comparatively no deviation from a straight line.

The barrel for this core should be not less than one inch thick, and for obvious reasons must be perfectly sound, with grooves at intervals around the circumference; the expense of cutting these grooves may be saved, if, when the barrel is made, prints be set on the pattern into which cores may be inserted along its length Fig. 39 will give some idea of what is meant; the form of groove shown is the least likely to damage the barrel from shrinkage.

These barrels should have at least ¼ inch taper in their entire length.

There is naturally more handling of such a core as this than is ordinarily the case, and, in order to facilitate this extra usage, I have shown at Figs. 40 and 41 the necessary preparations.

At *A*, Fig. 34, the gland is shown which holds the down pipe in position as well as serving to make good the joints at the top. During the process of making the core we substitute the plate *A*, Fig. 40, for the one shown at *A*, Fig. 34, bolting it to the barrel after the manner shown at Fig. 34, and for the opposite end a tapped hole is prepared, into which a threaded gudgeon is screwed, as shown at Fig. 41.

The eyes serve to lift by, and the turned shoulders give a true motion to the barrel as it revolves on its bearings, thus insuring a true core.

It will be seen at Fig. 41 that holes are cast into which irons can be wedged and bent to the form of the core at the lower end; this is better than attempting to carry the loam at this point with prickers, which are almost certain to be broken off the first time it is used.

The gudgeon at the lower end serves another good purpose, namely, that when it is desired to raise the core on end, previous to lowering it into the mold, the whole weight of the core may be sustained by it during the operation, keeping the core clear from all likelihood of damage, as well as facilitating the operation in a very great measure.

When the core has been suspended the bottom gudgeon can be taken out and the hole plugged.

The bracketed lugs, cast on the core barrel, and seen at *B B*, Fig. 34, serve a double purpose in this case. As may be observed, these lugs rest on the tripod *C*, at that point over the holes shown at plan of same at Fig. 42. This tripod must be of sufficient strength not only to sustain the weight of the core, but also to resist the pressure under the same when the mold is filled, which is far greater than its own weight, as may be ascertained by consulting article, "Pressures in Molds," published in the AMERICAN MACHINIST, August 18, 1888.

To accomplish this the barrel is secured to the tripod by bolts, as shown at *B B*, and the tripod made fast to the top flange of casing, as seen at *D*.

I have purposely shown the leg on the left out of position, so that the whole arrangement for setting this core might be shown.

It will be seen at plan, Fig. 42, that there are two holes on the ends of each leg; one of these is to bolt down with, as at *D*, Fig. 34, and the other, being a tapped hole, is to be used for raising or lowering the core when it is being set in position.

The terminations of the grooves in the barrel are shown at *E E*, Fig. 34, about twelve inches higher than the top of the casting.

Whatever soft material is used for wrapping the barrel before rubbing on the loam, be sure and use no more than will barely cover the grooves, and thus keep out the loam; for if too much of hemp, hemp rope or hay is used, the pressure around the core will crush in the loam, the thickness of which in this instance should not be less than 1¼ inches.

Some cores for hydraulic cylinders may be required as long as thirty feet. These must of necessity be made in two lengths, and this can be accomplished very readily by adopting the method shown at Fig. 43, which is a sectional view of the junction of the two core barrels.

The barrels must be made thick enough to allow of one being bored out about 18 inches deep to half its thickness at that point, and the other turned to a snug fit in the same, as shown; a keyway must be prepared to admit a tapered key, which, when driven home, will be equidistant from each side of the core, the spaces at the back *A A*, as well as the seam *C*, being afterwards made good.

To close such a mold with the core made as above described, let the casings be set upon each other until as many are down as will allow the first core to stand one foot above the joint of the upper casing, indicated by lines *B B*; the upper length of core can then be set as previously explained, and the remaining flasks closed over.

In bringing these articles to a close, I would say that it has been my earnest endeavor to introduce such jobs as would bring into operation methods which may be made of almost universal application; and whilst it would not appear that very many examples have been chosen, it will be seen, if a careful analysis is made of the whole, that such examples as were chosen embrace more of the every-day difficulties which beset the molder than could possibly be found in the same number of any other kind or quality.

It would, I know, have been easier to have selected a larger number, but the description of the methods for molding them would have been a mere repetition, and that I have endeavored to avoid.

MANUFACTURES

The Springfield (Ohio) Machine Tool Company will enlarge its plant.

The Bluffton (Ala.) Car Wheel Company has put its plant in operation.

A company is reported as to establish an ice factory in Shreveport, La.

The Columbia Car and Tool Works have been formed at Portland, Ore.

Frank H. Elson has broken ground at New Haven, Conn., for a boiler factory.

The recently burned Grove Fertilizer Works, at Perdix, Pa., will be rebuilt.

Holmes & Davis, Rome, Ga., will put in an incandescent electric light plant.

The Standard Iron Company is improving its plant at Martin's Ferry, Ohio.

The Camden Horse Railway Company will erect an electric plant at Camden, N. J.

There has been incorporated the Centralia Iron and Steel Works, of Centralia, Ill.

The Iron Company at Reading, Pa., will erect a pipe mill and employ 200 more hands.

McCormick & Co. will continue to make additions to their plant at South Harrisburg, Pa.

Operations will shortly be begun by the Bluffton Car Wheel Company, of Bluffton, Ala.

Wales & Eccleston, of the Nebraska City (Neb.) Iron Works, will erect a brick foundry.

An engine-house will be erected by the Webb Granite Company, of Worcester, Mass.

The Radford (Va.) Pipe and Foundry Co. will put in, it is reported, an electric light plant.

A new plant is being erected at Torrington, Conn., by the new Process Nail Company.

The Arethusa Iron Works Company, at Castle, Pa., will enlarge its finishing department.

The Monadnock Cotton-mill, at Claremont, N. H., is to be enlarged and new machinery added.

The Wheelock Engine Company, of Worcester, Mass., will erect a large plant at Chicago, Ill.

It is stated that James E. York will probably erect a structural steel plant at Duluth, Minn.

The Lake Shore Railroad Company will probably erect a small repair shop at West Seneca, N. Y.

Duluth (Minn.) parties have incorporated the Anti-Cokan Iron Company, with a capital of $250,000.

New machinery will be placed in the plant of the Rowan Knitting Company, at Salisbury, N. C.

There is talk of an extensive manufacturing concern establishing a plant at Lacrosse, Wis.

The city of Denton, Texas, may soon contract for an electric light plant and a system of water works.

The Thomson-Houston Company will erect a new power and experimental plant at Lynn, Mass.

The Norfolk & Western Railroad Company has broken ground for a machine shop at Bluefield, Va.

The Chester (S. C.) Manufacturing Company will most likely rebuild at once its cotton-mill, recently burned.

The National Hancock Rotary Plow Company has been incorporated in Virginia. Capital stock, $100,000.

It is understood that J. W. Pike will erect a factory at Amsterdam, N. Y., to manufacture knitting machinery.

A $50.000 stock company is reported as being organized to establish a fertilizer factory at Winchester, Va.

Kirckefer Brothers & Co. will erect a tin plate plant at Milwaukee, Wis., with an annual capacity of 6,000 tons.

O. F. Dozier has made arrangements for the manufacture of his patent mailing machine, at Birmingham, Ala.

It is stated that work will be resumed next week in several departments of the Clinton Foundry, South Troy, N. Y.

The Tibbetts Rolled Forging and Machine Company, of Boston, is talking of establishing a plant at Haverhill, Mass.

The Atlantic Coast Line (office, Wilmington) is reported as to erect extensive machine shops at Rocky Mount, N. C.

P. B. and Frank Brown have, it is stated, purchased the Anniston (Ala.) Ice Factory for $25,000, and will operate the same.

It is rumored that a brass works is to be established at South Newmarket, N. H., by Dover, Portsmouth and Boston people.

The Elm Grove Mill, Lincolnton, N. C., is reported as to put an electric light plant and new machinery in its cotton-mill.

M. M. Currie is endeavoring to organize a company for the purpose of establishing an electric light plant at Richmond, Texas.

Louis Arnold, of Louisville, Ky., will, it is stated, erect a factory in Durham, N. C., for the manufacture of ice by a new process.

The American Bridge and Iron Co., Roanoke, Va., is making arrangements to put in new machinery for building Bessemer steel rails.

Gainesville parties will probably establish an iron foundry and a machine shop in Velasco, Texas. Wall & Norfleet are leading the enterprise.

At Jersey City, N. J., the Bryant Sawing Machine Company has been incorporated, to manufacture machines for sawing iron. Capital, $100,000.

Detroit, Mich., is to have a new industry. The Detroit Car Window Ventilating Company has been formed, with a capital stock of $10,000.

It is stated that an English syndicate is making efforts to secure the iron furnaces, rolling-mills, etc., of the New Rome Land Company, at Rome, Ga.

The plant of the Baldwin Locomotive Company, at Philadelphia, Pa., is to be enlarged by the erection of two buildings, one 82x85, and the other 80x40 feet.

The Jackson Shell Roll Co., Pawtucket, R. I., is about to build a new and larger machine shop for the manufacture of their shell rolls and other specialties.

The Texas Copper Mining and Smelting Co., Henrietta, Tex., will, it is stated, erect copper smelting and reduction works at its copper mines in Clay County.

The People's Electric Light and Power Company has been reorganized at Birmingham, Ala., and the capital stock increased $40,000. Additional machinery will be put in.

A. W. Chamberlain, H. W. Tallant and W. C. Winthrop have incorporated the Arlington Heights Electric Company, at Fort Worth, Texas, with a capital stock of $100,000.

Improvements are to be made to the plant of the New Albany (N. Y.) Woolen-mill Company at once, and machinery for the manufacture of high grade woolen goods will be put in.

The Holland Radiator Manufacturing Company, of Chicago, Ill., is contemplating establishing a plant in Harriman, for the manufacture of steam and hot water radiators, etc.

Warren Delano, Jr., of East Orange, N. J.; J. G. Parks and others have incorporated the Burra Burra Co., at Ducktown, Tenn., to supply water or steam power. The capital stock is $100,000.

The Baltimore (Md.) Waste Co. has added eleven new waste machines, and will also put in five more new patent willows. They will continue to increase and will have a capacity of 100 bales per day.

A the annual meeting of the Holyoke (Mass.) Hydrant and Iron Works, the capital stock of the company was increased from $40,000 to $60,000, and the additional capital will be used in improving the works.

A stock company has been organized, to establish works for the manufacture of the Bonham adjustable harrow, at Livingston, Tex. C. H. Davidson is president; J. M. Drew, vice-president, and A. D. Sprott, secretary.

All reports to the contrary, the Horner Machine Company, of Holyoke, Mass., will remain in Holyoke and increase its plant. W. H. Pryer, recently of New York, has put in the necessary capital and has been made treasurer.

The Alexandria Safe Deposit Co. has been incorporated, at Alexandria, Va., with F. E. Corbett, president; L. C. Barley, vice-president, and A. A. Warfield, secretary, to construct safes, vaults, etc. The capital stock is $5,000.

The New York house of the Crescent Steel Company, at 480 Pearl street, this city, has issued a pamphlet in which is given a full list of the steel carried in the New York store. This will be found a convenience for buyers in this locality.

A new concern, to be known as the Ammonia Power Company, of New England, capital stock $5,000,000, $50 paid in, has been organized at Brunswick, Me., for the purpose of manufacturing machinery to utilize ammonia gas for power.

A new cotton-mill for Anniston, Ala., is an assured fact. The committee having the local subscription in charge has raised the amount demanded by the Boston company, which will build the mill. It will cost $300,000, and will contain 20,000 spindles.

The Bath (Me.) Gas and Electric Company have contracted to have their gas house extensively repaired and new machinery added. The company claim that when the job is completed it will be one of the best plants for gas manufacturing to be found anywhere in New England.

We have received from F. E. Reed & Co., Worcester, Mass., a new catalogue of their lathes and other machine tools, which are fully illustrated and described. Besides hand and engine lathes, the catalogue contains descriptions of various styles of milling machines, index centers, planer chucks, a scraper's bench, etc.

We have received a price list and catalogue of Justice Roe & Sons, 52 Broadway, New York City, containing illustrations and descriptions of their steel tape measures, pantographs, and combination pocket protractor, square, triangle, etc. The list also contains the titles and prices of a number of scientific books, which are of interest to engineers.

George A. Reed, of North Andover, is to establish a brass foundry at Gloucester, Mass., and has purchased a lot of land, comprising 10,000 square feet, between Maplewood avenue and Myrtle square, from George J. Marsh, agent of the Hough estate, and has contracted with Mr. Henry A. Norwood for the erection of a building 30x36 feet, which will be pushed forward as rapidly as possible.

The Berlin Iron Bridge Company, of East Berlin, Conn., have taken the contract for a new boiler shop for the Dry Dock Engine Works, at Detroit, Mich., The building will be 68 feet in width by 201 feet in length, and is designed and will be constructed entirely by the Berlin Company. They not only furnish the iron work, but also foundations, brick work, in fact, the whole building complete, ready for the machinery.

The State College of Kentucky, which is located at Lexington, has ordered of the Lodge & Davis Machine Tool Company, Cincinnati, Ohio, an equipment of machine tools for the new Mechanical Hall, which is being fitted up at the university. The wood-working department of this hall is already in operation, and it is intended to have the machine shop going as soon as possible, the object being to provide students with facilities for acquiring shop practice.

Curtis & Curtis, manufacturers of the Forbes Patent Die Stocks, Pipe Cutting and Threading Machinery, etc., of Bridgeport, Conn., have just shipped to a large heating company in Michigan, one of their No. 5 pipe machines. This machine is remarkable in several respects. With its great range, from 2½" to 12" inclusive, both right and left, either standard pipe thread or any other number of threads to the inch can be cut. It is thought to have the largest range of any pipe machine ever built.

The Elliott Hickory Cycle Company, of Newton, Mass., issue their catalogue this year in the form of an almanac, which is something of a burlesque on the ordinary patent medicine publication. It was written, of course, by our friend, Mr. Sterling Elliott, and contains a good deal of solid information regarding bicycles, and also considerable humor, though in this respect it will undoubtedly suffer somewhat by comparison with Mr. Elliott's previously published catalogue, which became famous. Nevertheless, the "Old Hickory Almanac," as it is called, will be found to contain many things that are interesting, instructive and amusing.

Machinists' Supplies and Iron.

NEW YORK, February 17, 1892.

Iron—American Pig—The market is unsettled.

We quote Standard Northern brands, No. 1 Foundry, at $16.75 to $17.50; No. 2, $15.75 to $16.50; Grey Forge, $14 to $14.50. Southern brands of good quality are obtainable at $15.75 to $17 for No. 1 Foundry; $15.25 to $16 for No. 2; $13.75 to $14 for Grey Forge.

Scotch Pig—Coltness is quoted at $21.50; Eglington, $20.25.

Antimony—The market remains steady at about the last prices. The inquiry is better for immediate delivery.

We quote Hallett's, 11c. to 11½c.; Cookson's, 14¾c. to 15c.; and L. X., 12c to 12½c.

Copper—The copper market is dull. Lake copper is held at 10.70c. to 10.75c. for prompt delivery, and 10.80c. to 10.90c. for forward delivery. Buyers' views are around 10 60c. to 10.65c. Casting copper continues steady at 10¾c. to 10⅞c.

Lead—The market is unusually dull, but steady at 4.05c. bid and 4 10c. to 4.15c. asked. Buyers seem to have little confidence in the stability of the values.

Spelter—The market is quiet at 4.60c. asked and 4.50c. bid for New York delivery. Smelters could unload considerable stock at the latter figure. Both sides are holding back.

Tin—There is no speculative interest, and all bids are below the views of the sellers. 19.70c. fully represents the market.

Lard Oil—The market is steady at 56c. for Prime City, according to holder and quantity. Western on spot is quoted at 55c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Mech. draftsman of first-class ability desires position in N. Y. or vicinity. BOX 50, AMER. MACHINIST.

Wanted—A draftsman who has had experience in printing press designing. Box 54, AM. MACHINIST.

Wanted—A skillful mechanical draftsman. Apply to S. R. Krom, 151 Cedar Street.

Wanted—Position by young machinist in drafting office. Address G., AMERICAN MACHINIST.

Designer of special tools open to engagement April 1st. Address E. W., AMERICAN MACHINIST.

Mech. engineer and draftsman, practical and theoretical, desires situation. H. H., AM. MACH.

Mech. engineer desires position as draftsman; preferably with m'f'g establishment. M., AM. MACH.

Wanted—Mechanical draftsman for detail work chance for advancement if competent. Address BOX 58, AMERICAN MACHINIST.

Wanted—A good draftsman; one familiar with pump work preferred; steady work, good wages. Address Improved Pump, care of AM. MACHINIST.

Molder wanted to take charge of foundry; must understand core work and mixing of iron and brass. Apply to La France Fire Engine Co., Elmira, N. Y.

Wanted—Foreman for general jobbing machine shop; write, stating experience, salary expected; give ref. Novelty Machine Works, Owensboro, Ky.

Wanted—Two good molders for steam and hot water heater work; none but steady men need apply. Address XX, care AMERICAN MACHINIST.

First-class tool maker and machinist, American, age 35, desires situation as foreman or assis't supt; large exp. gun tools. J. S. W., AMER. MACHINIST.

Competent eastern foreman wishes to make change April 1st; specialty, small work requiring accuracy. BOX 59, AMERICAN MACHINIST.

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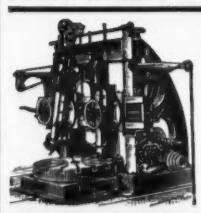

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22 do	12 do	do	New	Blaisdell
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22 do	10 do	do	do	do
20 do	8 do	do	do	do
20 do	10 do	do	do	do
18 do	8 do	do	do	do
18 do	10 do	do	do	do
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16 do	6 do	do	do	Blaisdell
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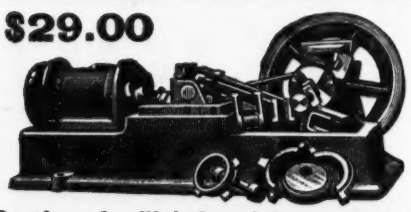

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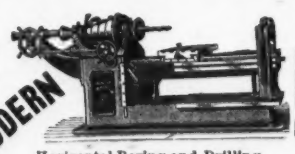

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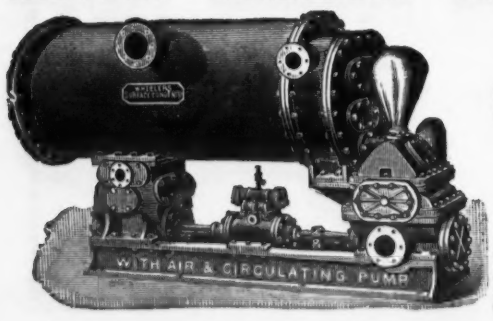

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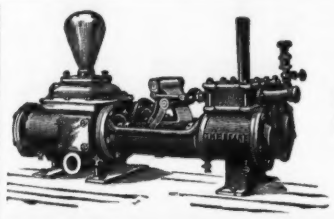

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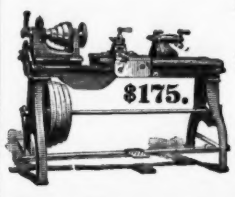

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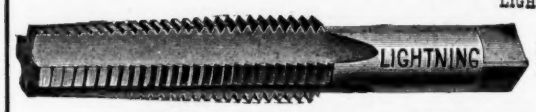

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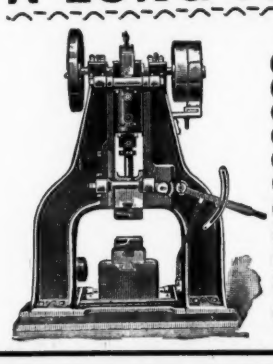

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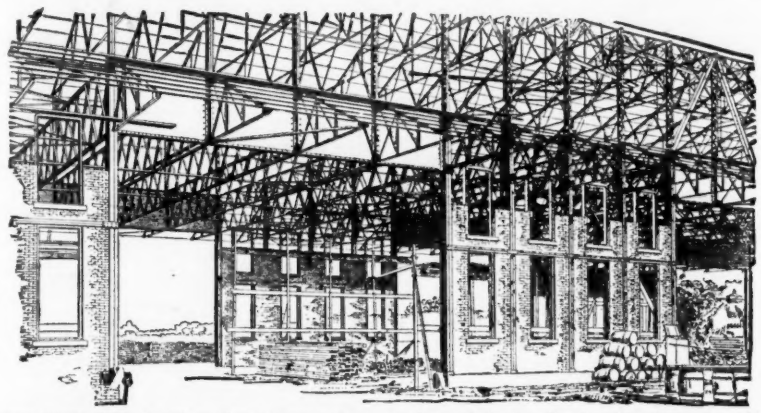

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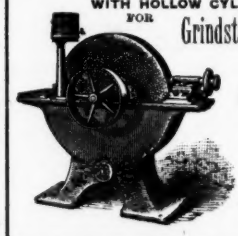

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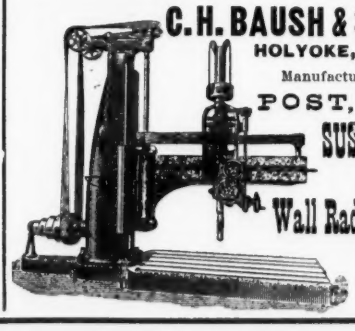

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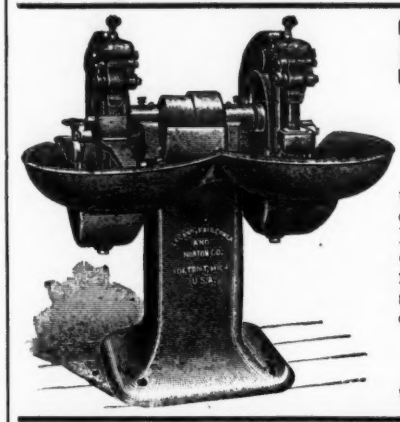

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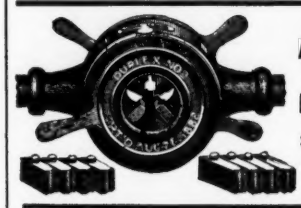

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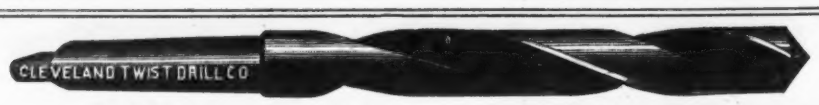

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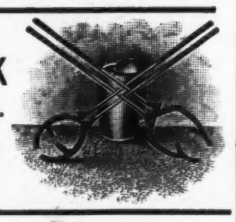

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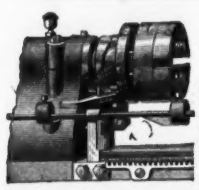

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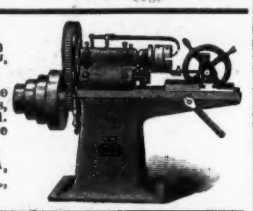

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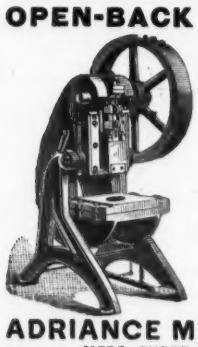

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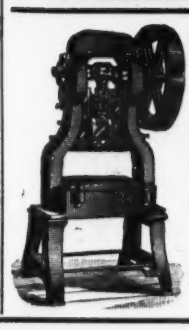

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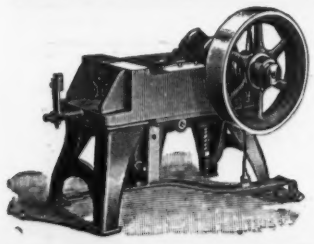

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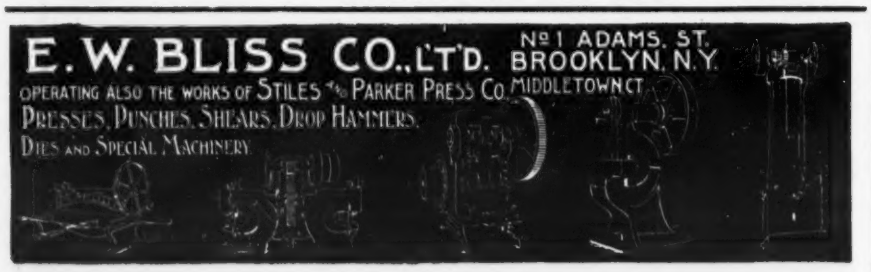
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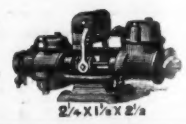

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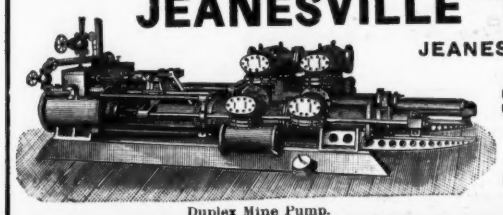

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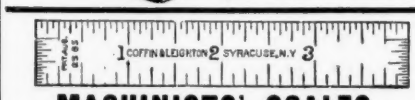

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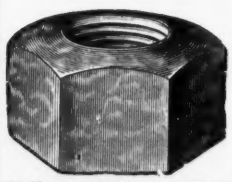

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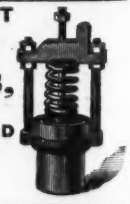

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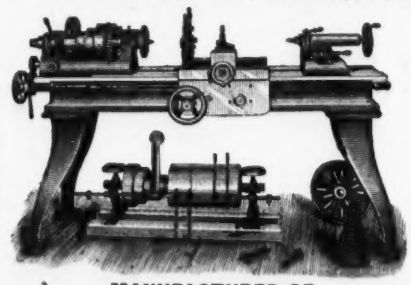

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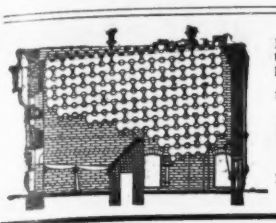

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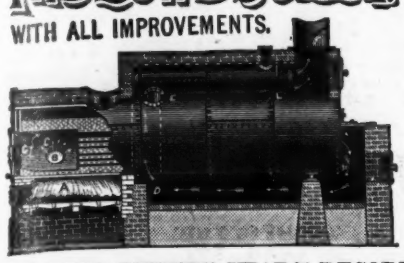

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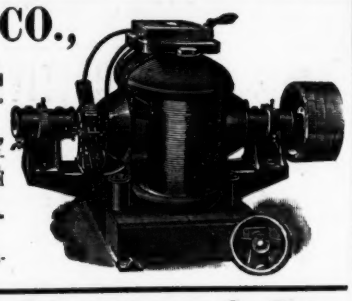

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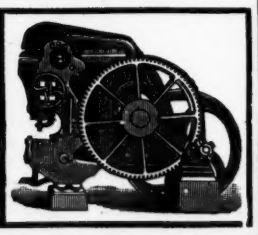

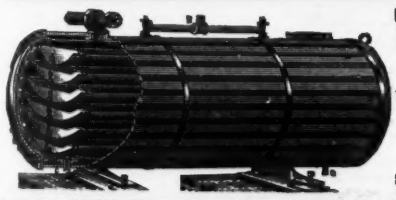

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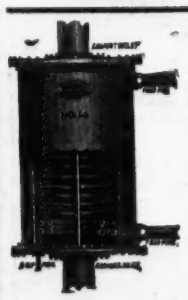

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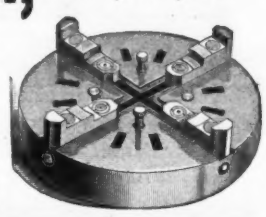

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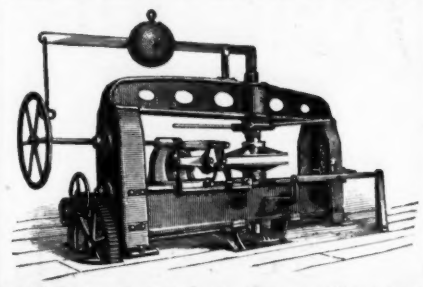

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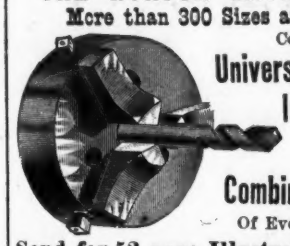

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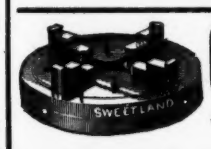

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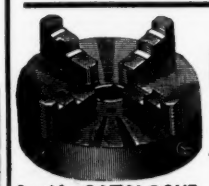

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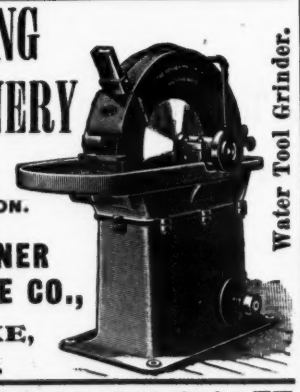

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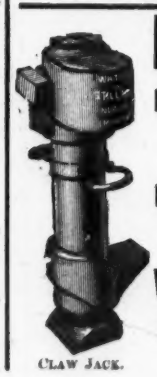

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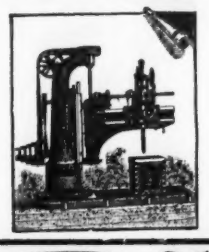

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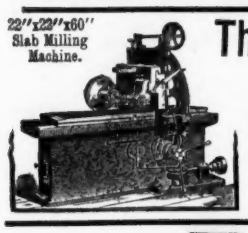

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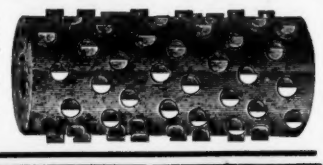

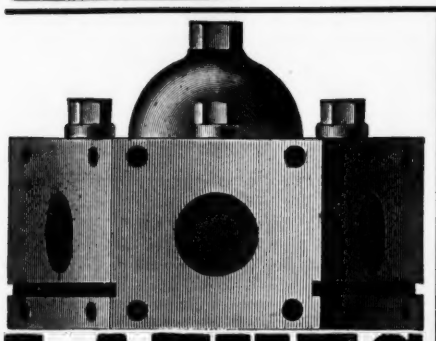

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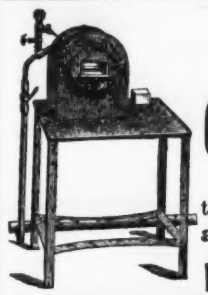

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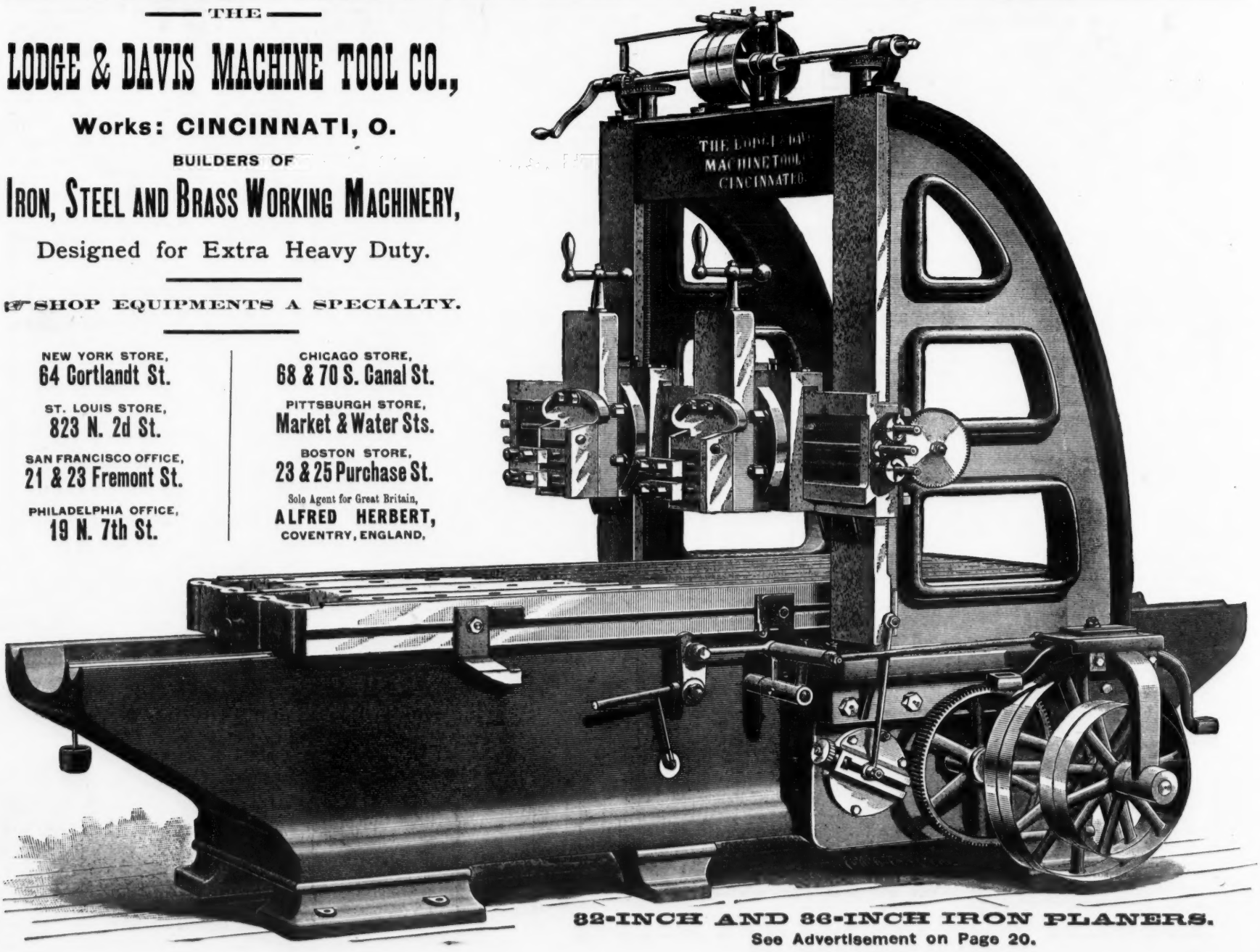

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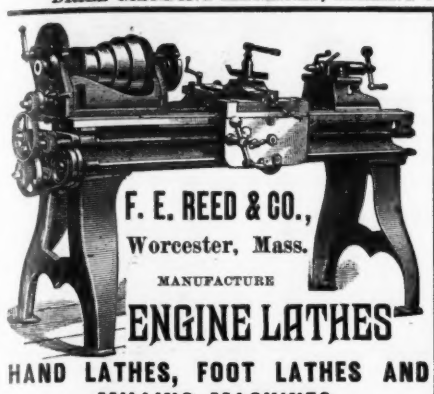

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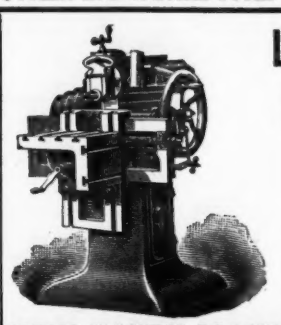

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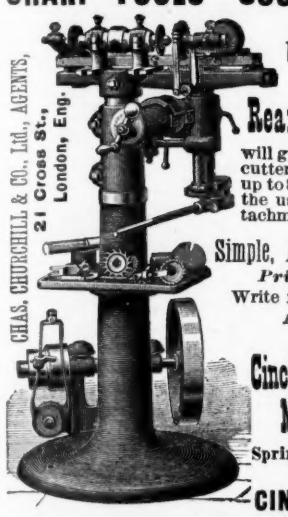

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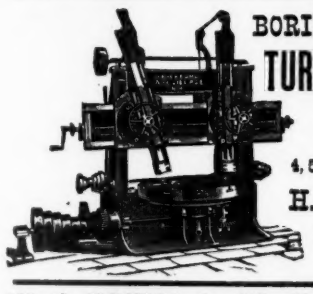

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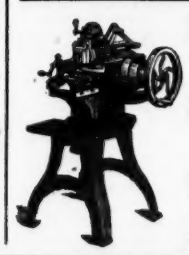

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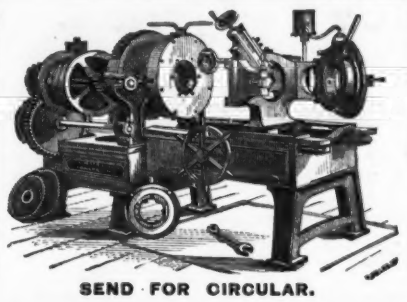

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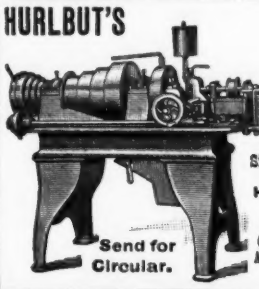

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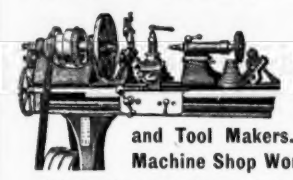

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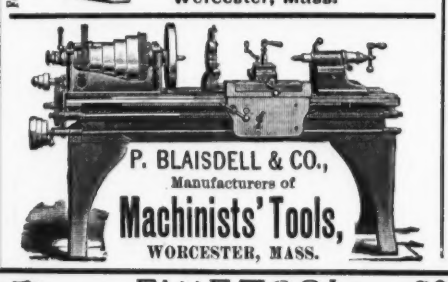

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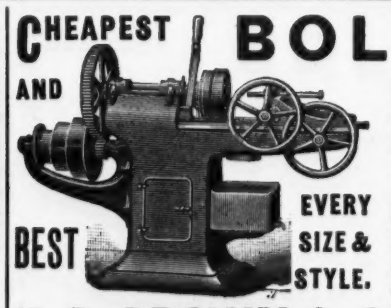

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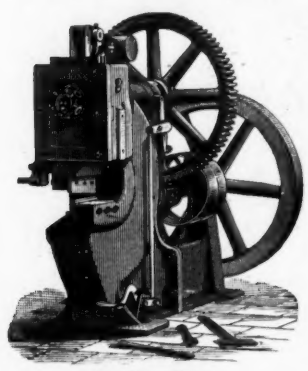
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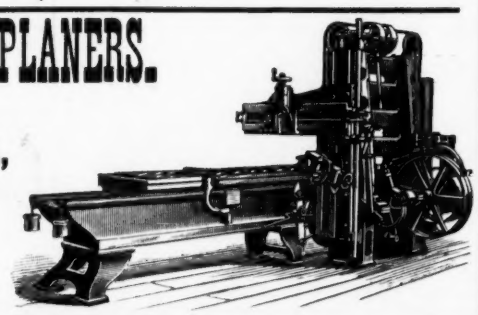

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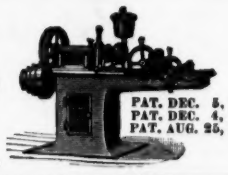
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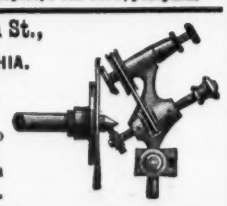

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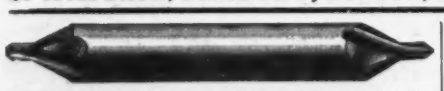
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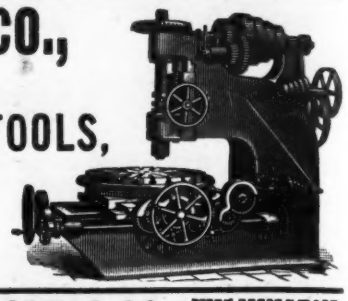

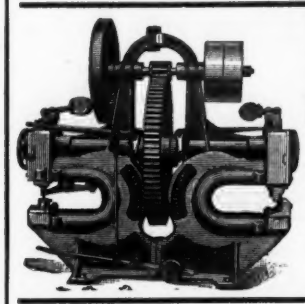
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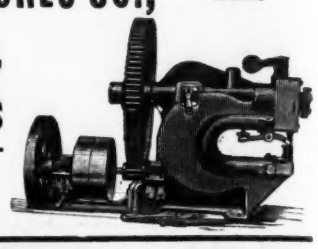

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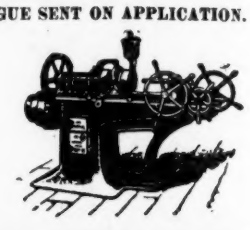

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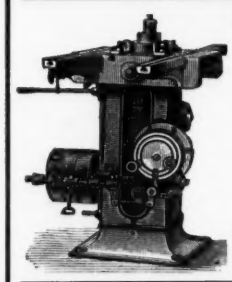
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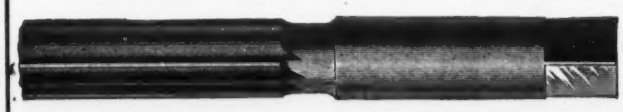
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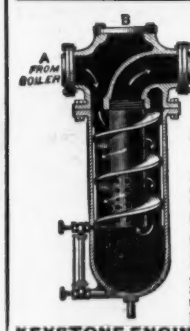

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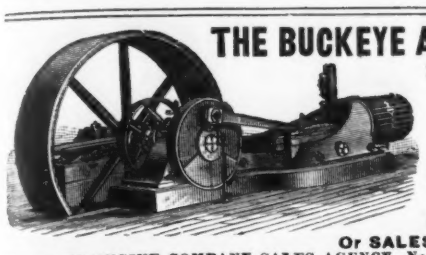

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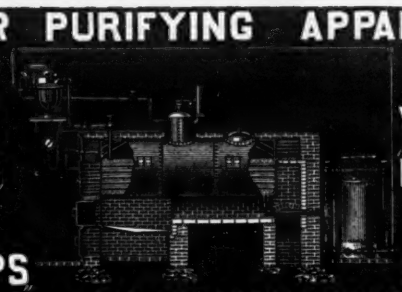

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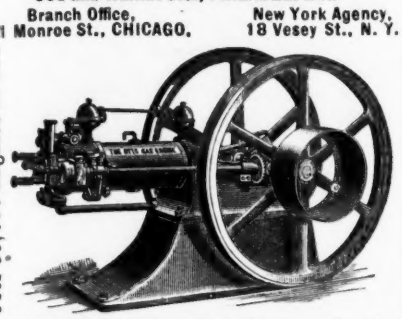

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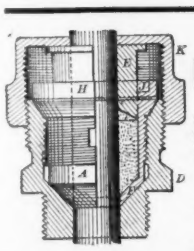

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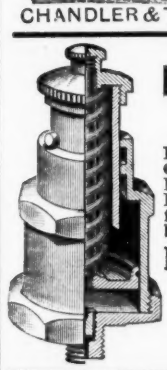

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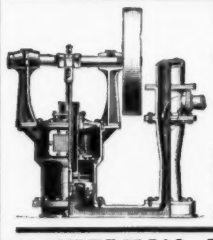

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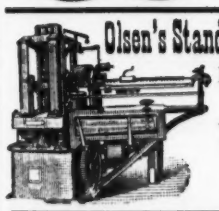

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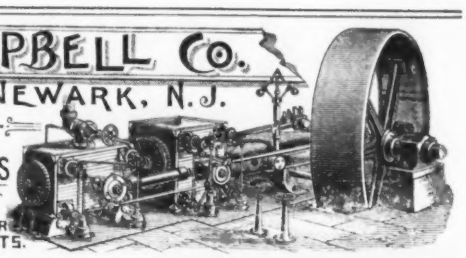

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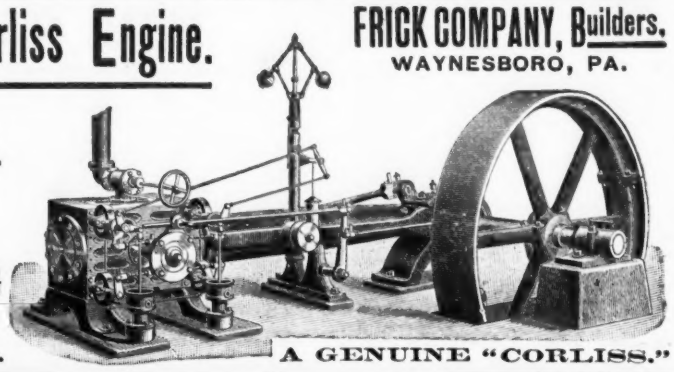

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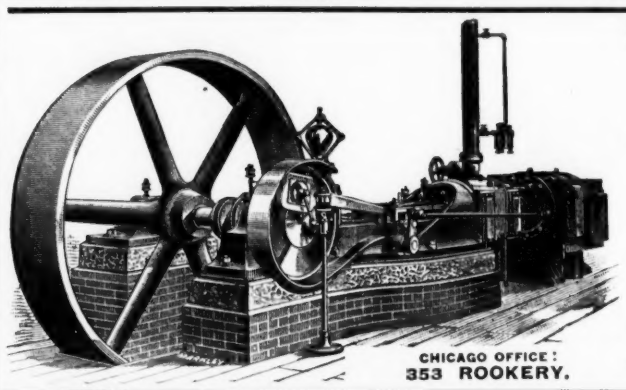

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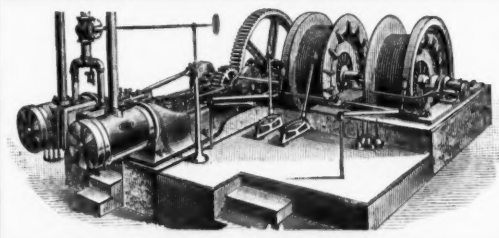

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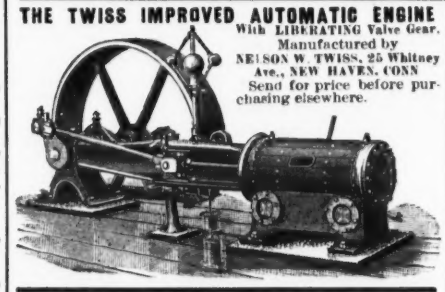

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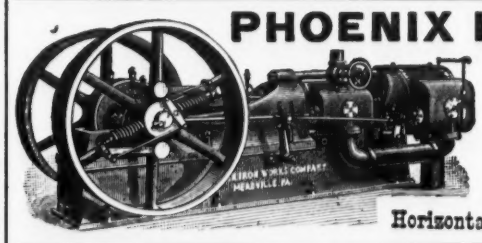

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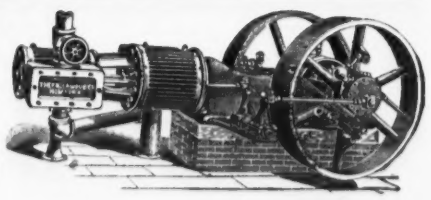

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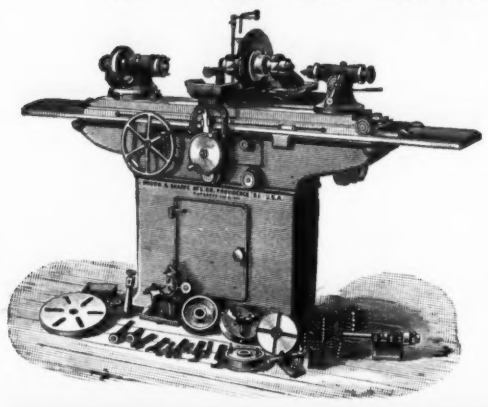

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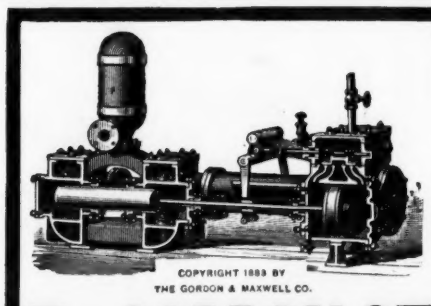

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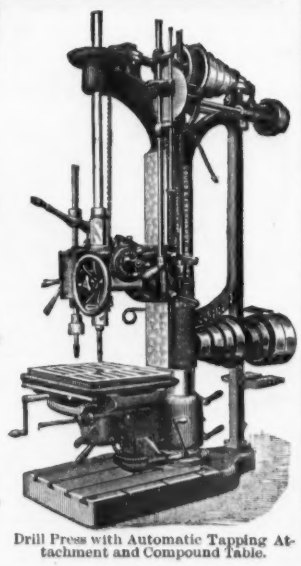

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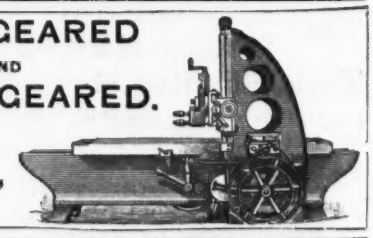

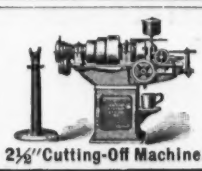

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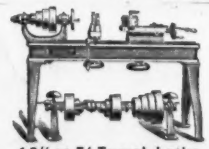

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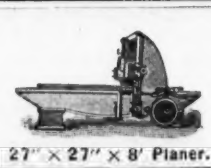

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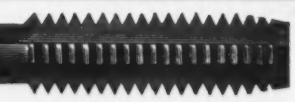

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